1934

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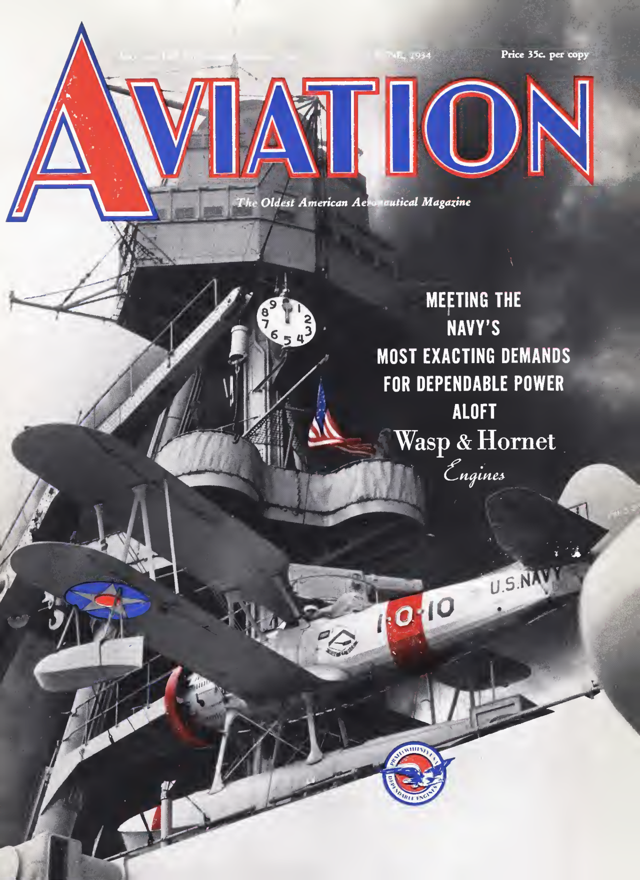
AVIATION

The Oldest American Aeronautical Magazine



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NRA MEMBER U.S. WE DO OUR PART

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AVIATION

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AVIATION
FOR JUNE, 1934

There are new sources of income awaiting commercial operators who are willing to abandon the idea that the aerial camera is an infernal machine, too dangerous and too expensive for them to use in their businesses. Aerial photography is frequently confused in their minds with mapping which does require specialized equipment and technique but ordinary obliques can be taken with modest equipment by anyone who is familiar with the principles of operation of the standard kodak. This article, based on several experiences, shows how it can be done.

Revenue from Photography

By Charles H. Gale
Fairchild Aerial Camera Corporation

FLYING SERVICE operators as a group have been slow in realizing the value of aerial photography as a source of income, partly because of certain misconceptions of the scope and technique of this type of operation and partly because of a belief, which has not been without foundation up to the present time, that the expense and complexity involved would not justify the potential revenue from this phase of activity. The notion that it is necessary to make extensive modifications in the structures of airplanes for this type of service is undoubtedly a result of the popular confusion of aerial photography and mapping in the minds of operators. This same confusion has led to a comparison of the investment necessary for the more expensive types of survey equipment with the prices of the airplanes on which it might be used and many operators have concluded that such luxurious properties were not for them.

Those who have studied the situation in greater detail have learned that it is not necessary to tear apart their ships nor must they purchase equipment designed for military or topographic services in order to produce highly satisfactory oblique photographs. But even this discovery has not induced a sufficient number of commercial operators to realize the possibilities for expansion that lie in this field because they believed the cost of oblique equipment, although relatively low, was still too high for their limited budgets.

With the advent of improved and still less expensive equipment, aerial photography has taken on a new significance but it remains a source of income which has been virtually untapped while the operators sought to exploit other flying activities and even various non-flying enterprises which held some promise of revenue.

Take an example to prove the point. Winston W. Kratz, manager of the St. Louis Flying Service at Lambert Field, observes that "The field of oblique aerial photography is wide open for the average operator. When we began taking aerial photographs last year, 1933, we scarcely expected to make a regular business of it. However it was soon apparent to us that there was a definite need for aerial photographs in many phases of business and now this department is one of our best money makers." This experience is particularly convincing because Kratz operates in a territory which has been a busy aviation center, with a certain amount of photographic flying, for many years.

The field of oblique aerial photography has the double advantagr of being easy to handle successfully and being the kind of photography which is in greatest demand. With modern equipment obliques can be taken of every type of subject by merely making ordinary adjustments and aiming the camera over the side of the airplane. There is no need of even a special mounting.

And it has been demonstrated further that modern equipment has been refined to the point where one doesn't have to be an expert aerial photographer to secure commercial aerial photographs which are readily saleable. At the same time, recent developments have gone far to eliminate the obstacle of expense, so this department of flying becomes available to more operators than ever before.

In order to add aerial photography to his operations the average operator needs only to acquire a suitable camera, alone or in partnership. He already has the aircraft, the operating staff and plenty of sales assistance—the part-time, commission services of friends, students, aviation enthusiasts at large, and perhaps of well-selected local photo supply stores,—for promoting the sales of air photographs.

The operator does not even need to

worry about dark room facilities as long as he has available the co-operation of a local professional photographer who has adequate developing and printing equipment. The co-operation of the photographer in many cases extends to partnership in the ownership and operation of the camera and in the promotion of sales, thus reducing still further the investment required for a competent aerial photographic service Operators have established successful working agreements with newspaper photographers, to cover both the actual operation of the camera and the darkroom work Howard H Maxwell, vice-president of the Central Aeronautical Corporation of Indianapolis, is one of many who has worked successfully with a local professional photographer The latter owned an aerial camera, did the photographing and supplied the plates, while Lieutenant Maxwell supplied the flying They co-operated on sales

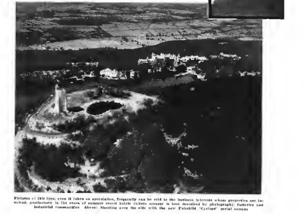
Others prefer to establish their own dark room and do the developing and printing themselves. This has been done, for example, and at small expense, by Kenneth Unger, who has successfully and profitably operated the Unger Flying Service at Hadley Field New Brunswick, N J, for a number of years He uses his aerial-camera lens for double duty, mounting it in an enlargrr built up around a camera body bought without lens at a bargain.

Revenue impressive

Mr Unger's experience is one of the outstanding examples of the potentialities of aerial photography for the commercial operator For two years he has used a standard Fairchild F 8 camera with an F4 5 lens, suitable for closeups in the air and on the ground as well as for obliques, and within a certain range for verticals He was able to regain his investment on the first orders secured

Despite the reduced amount of flying done last year, he was able in 1933 to net more than $600 with his camera That was $600 which he would not have had otherwise, — additional income picked up in what might almost be termed incidental work While in itself it is not a large sum it does represent an imposing return on a small original investment, and any activity yielding such a black-ink figure appears entirely worth while. Lieutenant Maxwell also reports that, for the time spent on his photographic missions, the monetary return was highly gratifying

Mr Unger uses supersensitive panchromatic film, and the existence of that film is one of the reasons why aerial photography now is easier than in the past The film is faster than the older types, and therefore the shutter speed can be faster That reduces the risk of spoiling negatives by blurring, a risk always present if the photographs must



Pictures of this type, even if taken on speculation, frequently can be sold to the business interests whose properties are involved, particularly in the cases of summer resort hotels (where scenery is best described by photograph), factories and industrial communities Above: Shooting over the side with the new Fairchild 'Cyclops' aerial camera

be made at slow shutter speeds Mr Unger uses filters when atmospheric conditions require them, and here again the improved film emulsions help the operator, for even with filters high shutter speeds can be used

Photo file an asset

Aerial service operators have found that aerial photographs systematically filed in a safe container constitute an asset of considerable value Repeat orders for prints of photographs are common, and photographs taken on speculation (that is, without specific orders) usually find ultimate purchasers

Repeat orders may amount to considerable revenue One order for a set of five aerial photographs of a new hospital in St Louis later brought Kratz orders for four additional sets

The Abrams Aerial Survey Corporation of Lansing, Mich, effectively displays its wares by issuing a catalog with half-tones of certain air views in their collection and listing hundreds of the most popular ones with a brief description of the subject The catalog includes an order blank and emphasizes the value of air views as gifts, as decorations in homes and offices, as a means of creating interest in air travel and as souvenirs of places visited as well as for industrial uses

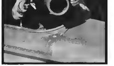
Speculative work

Considerable revenue has been earned by Unger by making it a practice to expose his entire film pack on each photographic mission and disposing of the results on speculation Thus, instead of returning with only the exposures which have been contracted for, he uses the balance of his film on whatever looks promising on the return trip Enough of these find purchasers to make the habit worth while

The St Louis Flying Service has followed the same practice successfully Last winter, for instance, it was engaged to make three aerial photographs of a projected park in a St Louis suburb and while on that mission, which required only an hour's flying, five speculative shots were obtained Ninety dollars was received for the contracted pictures and two of those taken on speculation were sold for $20 each, which was clear profit.

Most effective promotion has been found by Unger to be part-time salesmen working on a commission basis Window displays create interest, but he does not find them developing customers Salesmen can be drawn from among the students, friends, and visitors at the airport They may be paid in cash, or in flying or instruction time This arrangement not only secures orders but produces increased volume of flying and airport activity Lieutenant Maxwell has found air views published in the press with a credit line helpful

Kratz considers publicity received from photographs appearing in newspapers with a credit line the most effective type of promotion in his territory, and attributes two large orders directly to it While the newspapers paid only a nominal fee for the service the photographs were noticed by a construction company which had just finished a large lock in the Mississippi River 90 miles from the field A rush order was placed by long distance telephone, the mission was completed four hours later after only two hours of flying and $120 was paid for the job



One operator who has made profit out of aerial photography is Kenneth Unger of Hadley Field N J

Kratz also has found that when time is available business can be stimulated by making ten or twenty aerial photographs of prominent residences and institutions and selling them to the owners through personal calls He says that 40 per cent of these photographs are sold The 10x14 in. enlargements, mounted on attractive mats at slight extra expense, have been specially popular

Service charges vary

The charges for aerial photographic work must necessarily vary with each community For special orders Maxwell charges airplane time plus $25 for the first picture and $1 for each exposure following For individual orders Mr. Unger charges a minimum of $50 for two prints If the subject is within 25 miles of Hadley Field. Additional prints cost $5 each If the subject is beyond the 25-mile limit, the customer is charged the minimum price plus the regular flying time while the plane is beyond the 25-mile limit. Flying time on a New Standard, which Unger uses considerably, has been $20 per hour, on a Travel Air $30 per hour

Work handled on a long-time basis, such as the work he has done for state and county mosquito control commissions, is charged for in accordance with the conditions governing the nature of the job In the state-mosquito-commission work the camera was operated by a state employee who was given a short instruction period The state was billed for the flying time of the airplane and a nominal fee for the rental of the camera

Unger has found that on an average photographic flight he is able to secure about 24 useful pictures Each photograph, including the cost of developing and printing, costs him approximately $2.15, providing a substantial margin of profit

Prospects are plentiful

To date Unger has experienced greatest demand for aerial photographs of industrial plants and business buildings, public and private institutions, real estate subdivisions, private homes on both the group and special order basis, and such subjects as swamp and marsh drainage projects, water supply developments, building construction and sewage disposal plants for State, County, and City Governments He also has discovered closeup aerial photographs of owner-pilots flying their planes to be popular

Other customers for aerial photographs include Chambers of Commerce, civic organizations, owners and operators of resorts, transportation companies, construction companies, hotels, service clubs, and booster organizations of all kinds, utilities, large business organizations wishing particularly to illustrate their home offices or main plants

On the basis of their experience the operators who have tried it declare that aerial photography is something which all flying-service operators can undertake, but that it must be taken as seriously as any other part of the operator's business, must be pushed in a business-like manner, must be carried out neatly and efficiently Practically every community contains sufficient potential demand for aerial photographs to provide the operator with an important source of revenue He has only to go after it aggressively, and to make sure that he gives a good enough service on each order to bring more business from the same source.

Ingenious Pan American terminal design speeds parting guests and simplifies customs and immigration procedure for new arrivals at Miami

Port of Entry deLuxe

By William E. Berchtold

The traffic circle in front of the building is at the end of a driveway lined with coconut palms

AMERICA'S traditional fetishism for enterprises which bear the label "world's largest" has again been satisfied with the opening of Pan American Airways' new International Air Terminal at Dinner Key, near Miami. However, it is not the size of the terminal so much as the excellence of its layout plan for traffic handling which will attract the interest of those within the aviation industry.

Designed to handle as high as 750 passengers daily in addition to tons of mail and express, the new marine air transport station has been laid out on a simple, compact plan which will cut to a minimum the confusion usually attendant upon the arrival or departure of international transports whether by sea, air or land. The whole project shows unmistakable signs that some dyed-in-the-wool traffic and operations men have had a hand in the architect's plans, a practice not too frequently followed in the construction of air terminals throughout the country.

Four flying boats of the "Clipper" class, or even much larger, may be loaded simultaneously. The four loading floats are reached from the central terminal building through four covered walkways extending from the lower floor of the building. An extraordinarily well planned system of corridors for passengers (which may be controlled by a system of telescoping gates) and a series of passageways for operating personnel reduce possible confusion during embarkation or debarkation.

The building is so designed that all operating personnel who need not come in contact with the passengers, from the port captain to the pilots, meteorologists, radio operators, baggage handlers, and postal employees, are kept "behind scenes," yet all operating offices are conveniently connected by private passageways which are not opened to the public. Company personnel and other workers even have their own cafeteria on the lower floor of the structure. Mail and express shipments enter the building through an entrance provided for trucks and move through the terminal to the waiting airliners without ever coming into view of the passengers. Three elevators, one for mail and the others for outgoing and incoming baggage and express, carry all shipments between the main floor of the building and the lower floor which leads to the walkways and the loading floats.

The central waiting room

Passengers preparing for embarkation are received into the attractively decorated two-story central waiting room, 48 by 80 ft. Murals depicting historical episodes in man's age-long attempt to solve the problem of flight decorate the upper portions of the central lobby, which is surrounded by a balcony on the second floor level. The major air routes of the world are featured on a 10-ft. globe in the center of the waiting room. Illuminated and electrically operated bulletin boards record all arrivals and departures for the benefit of passengers or visitors.

Porters who meet passengers arriving at the main entrance to the building take all baggage through a separate entrance just to the right of the broad stairway used by passengers. All baggage, traffic and clearance operations are concentrated along one end of the lobby. The traffic desk, flanked by scales for the weighing of passengers and baggage, is large enough to permit eight clerks to sell tickets simultaneously, while the traffic office just behind the desk is large enough to accommodate ten additional clerks. Public telephones, a telegraph office and other concessions have been provided in the central waiting room.

When the departure bulletin board flashes instructions for passengers to proceed to one of the four loading floats or the loud speaker system announces

The International Air Terminal as it looks from the air

Eight ticket salesmen can operate at one time at the traffic counter in the lobby

Four "Clipper" ships can be loaded or unloaded simultaneously

the imminent departure of a plane, passengers proceed to the lower floor of the building down a short flight of stairs. There can be no confusion in their reaching the proper loading float, folding gates cut off all possible exits except the proper one. Eight gates have been so placed in the three major corridors which feed all passengers to the waiting planes, that there can be no question about direction. Mail, express and baggage has been loaded before the passengers' arrival on the float.

Passengers debarking at an international airport of entry present the most complicated problem which must be solved in assuring the facile movement of passengers through such a terminal. The folding gates in the corridors of the lower floor again play their role in directing the flow of traffic, incoming passengers being shunted up a flight of stairs which lead directly into the offices of the United States Public Health Service and then into the Immigration and Customs inspection rooms. By the time passengers have reached the customs inspection, all baggage has been laid out on a long counter which winds around three sides of the room. Baggage is brought directly from the airliners to the customs room on trucks which are hoisted on an elevator to the main floor relieving the passenger of all responsibility. The incoming passenger's first contact with friends or relatives awaiting his arrival is made as he moves into the central waiting room from customs inspection.

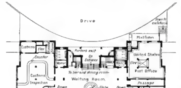
Friends who accompany passengers to the terminal or visitors interested in watching the arrival and departure of the airliners are given free rein in the central waiting room, on the balcony which surrounds it, on the three outdoor observation decks which overlook the port, and in the bar and dining room on the second floor of the building. They are not permitted to enter the lower floor of the building (reserved for loading operations), or to enter those parts set aside for customs, immigration, health or company employees. The dining room overlooking Biscayne Bay accommodates 100 persons while 50 additional places may be set on the open deck in front of it if necessary.

The pilots' room, port captain's office

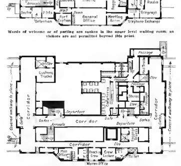
and general offices are located on the main floor of the terminal with a commanding view of Biscayne Bay The United States Postoffice, meteorologists' room, and radio operators' department are concentrated on one side of the main floor, while the customs, immigration and health inspection rooms are on the other side of the floor A vault, storage rooms, employees' cafeteria, and offices for the beaching crew are on the lower floor, which is chiefly devoted to the three major corridors through which all traffic moves to the loading floats. Telescopic canopies cover each of the four walkways to the floats

Pilots and docking officials receive their signals for the movement of planes through three colored lights imbedded in the concrete ends of the walkways leading to the floats This eliminates all verbal or bell signals

The terminal building is the central unit of the international marine air base which Pan American Airways' officials say will cost more than $1,000,000 when completed The new building, which is 54 ft high, 114 ft deep and 167 ft long, is of structural steel and masonry construction, with stucco walls and concrete foundations, supported by piling to solid rock The interior trim is hollow metal with window frames of drawn bronze Lobbies and promenade decks are floored in tile The white stucco exterior is dazzling to the eye under the tropical sun. The building is reached from the main highway through an impressively landscaped driveway, lined with coconut palms, and ending in a traffic circle in front of the entrance.



Words of welcome or of parting are sunken in the upper level waiting room as visitors are not permitted beyond this point



A system of gates is used to guide passengers along the proper corridors on the lower level which are connected with the four covered walkways

Hangars to the North

Ramps on both sides of the terminal building enable beaching crews to handle the big flying boats when they are being prepared for flight or have finished their daily runs Two large hangars north of the terminal building are now used to house the airliners, although the completed airport plans call for additional hangars south of the terminal as well The government has just completed dredging a mile-long channel, 700 ft in width and with a uniform depth of 7 ft of water at low tide This channel is necessary for the safe operation of the fleet of huge flying boats of the "Clipper" class and the still larger airliners already ordered for Pan American's routes which link the United States with 32 countries and colonies of Latin America

Because all of the schedules out of Miami, except those to Havana and Nassau, require flights of a full day's duration, the brunt of the traffic volume is borne during the early morning and late afternoon hours If this uneven distribution of arrivals and departures could be spread out throughout the day the new terminal's capacity might be increased beyond the 750 daily passengers for which it has been designed Traffic has increased steadily since the opening of services out of Miami in 1928 until now more than 2 000 passengers 6 000 lb of mail and 3,500 lb of express are handled each month throughout the year During the winter season passenger traffic exceeds 1,000 persons weekly

The basic design of the terminal building and the operating facilities of the international air base was worked out by Fred J Gelhaus, airport engineer for the Caribbean division of the Pan American System, and his assistant, B W Reeser, with the advice of traffic and operating officials of the company. Delano & Aldrich, New York architects provided the architectural design for the structure The whole project has been under the eagle eye of Roscoe I Dunten, manager of Pan American's Caribbean division It is certainly one of the best planned terminal buildings on land or marine airports in the United States today The added complications of providing facilities for the rigmarole of health, immigration and customs inspections (not usually a problem of the domestic airport designer) have been taken in stride It is a glimpse of heaven for traffic and operation officials

Hangar Flying

An old joke turns out to have its more serious aspects

A veteran pilot tries hangar flying Casey Jones goes under the hood for radio beam instruction

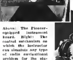
TIME WAS when an article about hangar flying was tossed without question into the basket of our "Side Slips" editor, but here's one that falls in quite another category Over in the Rockefeller Center offices of the Casey Jones School of Aeronautics, hangar flying takes on a new meaning One "flight" under the hood of the latest type Link Trainer with its full complement of instrument and radio equipment is a convincing demonstration that here is a device that is no mere amusement park attraction, but a new tool which, if properly applied, can be of material assistance in training pilots for blind flight by instrument and radio.

The Link Trainer itself is not basically new It was developed some five or six years ago by E A Link of Cortland, N Y, for preliminary flight instruction It is a sort of disembodied cockpit sprouting rudimentary wings and tail, mounted universally on a pivot. A hidden mechanism of the player-piano-pneumatic type simulates the movements of an airplane in the air from operation of a normal stick and rudder bar Although the behavior of the machine approximated that of an airplane to a reasonably good degree, it was never widely adopted as a substitute for actual hours in the air for primary instruction When Link applied a special set of Pioneer instruments (compass, air speed meter, climb indicator and turn-and-bank) whose readings were made to jibe more or less accurately with the attitude of the trainer, its possibilities for blind flying instruction for experienced pilots began to be recognized His most recent application of radio, however, has materially broadened its scope

Radio signals originate in a miniature beam transmitter (operated by the instructor) whose characteristics are essentially the same as those of the full scale radio range stations Automatic reproduction of the common A, N, and "on course" signals is provided—broken periodically by station identification Signal intensity (ordinarily a function of distance from the transmitter) is controlled by a rheostat The rheostat knob and the crank and pointer control for course indications can be seen in an accompanying photograph The student under the hood receives all signals through the usual form of radio headset

Where from 25 to 70 hours of instruction in the air is normally required to give a trained pilot a good working knowledge of instrument and radio beam flying, sponsors of the device claim that fifteen hours under the trainer's hood (the first five on instruments alone and the second ten on instrument plus radio), supplemented by five hours in the air, offer an equivalent in experience. The cost of training on the Link device is considerably less than the equivalent air instruction Greatest time saving arises from the fact that no long distances need be flown to hunt for representative beam or instrument flying problems Any of the innumerable combinations of speed, distance, direction or weather, can be simulated by the instructor controlling the radio set The student can thus work on a wide range of problems and can repeat any given problem in a matter of minutes instead of having to waste the time in flying back over 10 or 20 miles of airway to repeat a given set of conditions

A great deal of interest has been exhibited in the new device Six units have been sold to the U S Army for June 15 delivery—one to the Japanese Navy U, S Navy and Russian officials have investigated also and are contemplating purchases Those of us who, as ex-flying cadets, remember long hours spent on the miniature artillery spotting ranges, or who have seen an account of an indoor device for training bombers in British flying schools, can add the radio equipped Link Trainer to our list of hangar flying devices which really perform some serious function



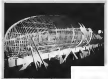
Above: The Pioneer-equipped instrument board. Right: The control mechanism on which the instructor can simulate any type of radio navigational problem for the student under the hood

Aircraft

Right: Float making in the woodworking department of the Naval Air Establishment.

Below, right: Native elm and camphor wood construction with Shantung silk or Kiangese rustic cloth covering and Foochow Lacquer are used in float building

Left: A strong resemblance to the historic J N 4D is detected in the "Char," two-place primary training seaplane with the Curtiss OX-5 engine. The first of the Char seaplanes was completed late in 1918. Below: For students who had mastered the Char, the "Yee" was constructed about four years later. It was similar to the Char but showed slightly higher performance with the 100 hp. Hall Scott engine.



Right: Bombing and fighting were the missions assigned to the "Heeng" flying boat with a twelve cylinder Rolls-Royce geared engine developing 360 hp at 1,800 r.p.m. Above: The hull structure of the "Heeng" was built up of native elm

Manufacturing in China

By Harrison Forman

One of the few non-political institutions in China, the Naval Air Establishment, has progressed slowly but surely in the work of applying native materials to the construction of airplanes. Since the spring of 1918 this organization under the direction of able men trained in China, America and England, has struggled through revolution and political change, hindered mainly by scarcity of funds. A number of the airplanes it has built by tedious hand work are described in the accompanying article.

UNTIL recent years China has been an almost totally non-manufacturing country. It is only in the last two decades that she has begun to enter the self-productive field. This activity has been stimulated by the awakening of national consciousness since the Revolution in 1911. Without a background of accumulative years of experimental and research work in the evaluation and use of home products, China, of necessity, had to content herself at first with simple establishments for the assembly of the segregated foreign-made parts into the finished whole.

It was not until the final year of the War that China took an active interest in the construction of aircraft. Under the supervision of the Chinese Navy the Naval Air Establishment was created in the spring of 1918 with headquarters at Foochow in the province of Fukien.

Four well trained men were placed in charge of the administration of the establishment, and the design and construction of aircraft. These men were Lieutenants (now Captains) Y. T. Barr (Barr Yu-tsao), Y. K. Tseng (Tseng Yee-king), T. Wong (Wong soo) and S. F. Wong. Lieut. S. F. Wong resigned in 1921. All of these men, besides an early training at home, had obtained extensive technical and aeronautical experience abroad—especially in England and America.

In order to save time and the initial cost for the erection of a new plant and the installation of new equipment suitable for the work contemplated, a part of the Navy-owned Government Dock and Engineering Works, commonly

Above: A three-cylinder Bristol engine of about 125 hp constituted the power plant of the "Wu," a twin float observation seaplane whose fuselage was characterized by the absence of wire bracing. In the foreground are the members of the executive staff at the Naval Air Establishment. Above, right: More recent in Chinese aircraft history is the "Ding" bombing and torpedo plane powered with the 360-hp Rolls Royce engine. This ship was a development of the "Wu." Top: The year 1933 brought the "Chiang Hung," designed around the 185-hp five-cylinder Wright Whirlwind engine. Although designed for training it may be used for passenger carrying, as is the case with many military planes of Chinese manufacture.

known as the "Foochow Dock," was allotted to the N.A.E. for its start.

At the outset engineers in the N A E were confronted with a dearth of scientific information on such home products as were of likely value in airplane construction As it was the intention of the officers to make as much use of home products as possible, the first thing done before actual construction began was to carry out tests and research work in order to discover materials which would have the same or equivalent qualities, properties and strength of those that had been found to be suitable and were in common use in aeronautical industry abroad

Materials

Some ten species of Chinese soft and hard woods were tested according to the best scientific standards *Shanmu* (Cunninghamia lanceolata Hooker) which abounds in the mountain forests of Fukien was found to possess qualities about equal to those of Grade A spruce as specified by British and American standards This timber has since been used extensively in the construction of main strength members such as wing spars, fuselage, longerons, etc

Indigenous elm (Ulmus parvifolia Jacq.) has mechanical properties similar to American rock-elm, and has been mainly used in the construction of seaplane floats and flying-boat hulls Camphor wood (Cinnamonum Camphora Nees et Ebermaiser), and especially its roots, on account of its toughness, fineness and natural crookedness of grain and great shearing strength, has proven most valuable in the making of knees or bracing members and gusset plates in the construction of floats, hulls and Warren truss types of fuselages This wood is a special product of South China *Baih* and *Nanmu* (Machilus ichangensis Rehd et Wils.) also on account of their toughness and fineness of grain have been used on minor parts of airplanes

Of the different kinds of silk, cotton and ramie or grass cloth tested, Shantung silk and Kiangsi ramie cloth were found up to the strength requirements A quantity of these two kinds of fabric is manufactured by the mills to the special specifications of the N A E., and is used for wing and fuselage covering Shantung silk, however, has a tendency to lose its tautness under abnormally humid atmospheric conditions As these conditions were rather prevalent in the late spring and early summer in Foochow the use of this fabric on those machines which chiefly operated in the South was discontinued

Climatic conditions also affected two kinds of dope which were formulated and used after a great deal of experimental and research work These were later replaced by imported dopes, which were known as P D N 12, a pigmented, nitro-cellulose dope, and V 84, an aluminum nitro covering Three coats of the pigmented dope and two coats of the aluminum dope proved very well suited to the semi-tropical climate at Foochow and the South, and never gave trouble.

For the protection of wood in the internal work such as wing frames, fuselages, interiors of floats and hulls a varnish made at the N A E with *Tung* oil as its chief ingredient has been employed with satisfactory results It exceeded all the requirements as laid down in both British and American specifications Specially treated varieties of Foochow Lacquer, which is world famous, have been successfully used for protection against weather on all external woodwork, against the fouling on float and hull bottoms and against corrosion on steel fittings. Apart from its engineering value, lacquer is valuable in that it can be finished in any color scheme desired and gives a brilliant and perfectly smooth surface When properly prepared and skilfully applied it is very light in weight and has absolutely no tendency to chip

Since its establishment in 1918 the N A E. has produced altogether five distinct types of seaplanes and flying-boats ranging from training machines to bombing and torpedo planes Owing to financial limitations, however, only twelve machines were constructed at Foochow As the operations of the Navy are all on the water, and furthermore, as there were no landing fields or airdrome available near Foochow, no land machines were constructed; although some designs for landplanes were worked out

The "Char" primary trainer

The Type "Char" was designed for primary training The first machine of its type was completed towards the end of 1918 It was a tractor biplane with twin float arrangement for undercarriage The wings and tail surfaces were of *Shanmu* and silk construction Interplane bracing was effected by two pairs of streamline *Shanmu* struts on each side of the fuselage, together with high tensile steel bracing steel wires. The floats were of streamline form and had V-bottoms Keels and chines were of elm and frames of *Shanmu* The skins of the floats were planked by two plies of narrow thin strips of *Shanmu*. The two plies were laid at right angles to each other, each ply being at about 45 deg with the fore-and-aft axis Between the two plies of planking there was a layer of fabric impregnated with waterproof marine glue to ensure water-tightness and strength Each float was divided into five watertight compartments, and was designed with 100 per cent reserve buoyancy

This machine was powered with an 8-cylinder V-type, water-cooled Curtiss OX-5 engine developing 100 hp at 1,400 r p m Its high speed was 75 m p.h and landing speed 35 m p.h

Type "Yee," an advanced trainer

The type 'Yee" was similar in general construction to Type "Char," except that the wing area was smaller and the high speed and landing speed were increased to 90 and 40 m p.h respectively This type was designed for use by students after they had mastered Type "Char." It was fitted with a four-cylinder vertical water-cooled Hall-Scott engine, the power and speed of which were the same as the Curtiss engine

Both Types "Char" and "Yee" were designed to a minimum load factor of eight and their loaded weight was about the same, *viz*, 2,100 lb The range for each was about three hours, flying at high speed near sea-level As first constructed, the gasoline tank was installed under the student's seat with feed to the engine by pressure. On later machines, the tank was mounted in the top center section.

Type "Beeng" for bombing

Type Beeng" was a tractor biplane flying boat designed for bombing and fighting; but, with slight modifications it could be adapted to passenger carrying As a bomber and fighter it carried a crew of three, a pilot and two gunners The pilot's cockpit was situated in the hull of the boat a little to the front of the leading edge of the lower wing, where the pilot had an unobstructed view forward, sideways and downward The first gunner's cockpit was at the extreme bow of the boat while that of the second gunner was behind the main wings. Both gunners were provided with machine-guns mounted on Scarff rings by means of which the guns could be swung in any direction desired With the guns thus located the field of firing was covered in nearly all directions The only blind spot was a small angle allowance for the tail, which was unavoidable As fuel was contained in tanks in the upper wing, the hull space between the pilot and after gun cockpits was free for the stowage of bombs and machine-gun ammunition

The power plant was a twelve-cylinder V-type water-cooled Rolls-Royce engine which developed 360 hp at 1,800 r p.m. It was geared and the speed of the propeller was reduced to 1,080 r p m The total weight of the plane was 6,500 lb. Overall dimensions were—span 56 ft, length 39 ft and height 16 ft 7 in The hull, which was of the flexible or Linton Hope type of construction, was 36 ft in length

The general-purpose "Wu"

An observation or general-purpose machine, known as Type "Wu," was a twin float single-bay tractor biplane. Its chief characteristics were simplicity of construction and ease of maintenance. The Type "Wu" was distinctly marked

from its predecessors in its fuselage construction In this fuselage, except for the engine mounting in the nose, no metal fittings or wires were employed. It was built up in the form of a Warren truss, composed of four longerons of *Shanmu* and a number of struts of the same material The attachment of the struts to the longerons was by means of two-ply camphor wood gussets, glued and copper riveted This construction proved very rigid and strong under bending and torsional tests and proved entirely satisfactory in actual service

Three seats were provided in the fuselage, two side-by side seats in the rear cockpit and one in the front, the floor of which was arranged to permit the installation of a camera for aerial photographic work or bomb sights and bombing controls. Except in the fuselage all the struts in this type of machine were made of steel tubing faired with hollow wooden tail pieces for streamlining The engine fitted was a three-cylinder radial air-cooled Bristol developing 120-130 hp The gross weight of this plane was 2,000 lb The span was 35 ft. 5 in, overall length 26 ft. and overall height 12 ft 3 in

Type "Ding" torpedo bomber

One of the more recent ships, type 'Ding," was a bombing and torpedo plane, fitted with a 300 hp Rolls Royce engine Provision is made, however, for the installation of an engine of greater horsepower if desired. Its total weight is 5,900 lb. with a military load of 220 lb Its general method of construction is similar to that of type ' Wu," except that the two floats are supported on separate and independent structures with clear space between them to permit a torpedo to be slung under the fuselage and launched without hindrance.

Provision is made for two cockpits and a cabin in the fuselage The pilot's cockpit is under the trailing edge of the upper wing, where there are two side-by-side seats Behind this is the gunner's cockpit Between the pilot's cockpit and the engine compartment is the cabin for the bomber This is built of generous dimensions with a trap door and bombing gear installed

When used for passenger carrying, four persons can be comfortably accommodated in the cabin, the head room of which is sufficient for persons of normal height to stand upright The cruising range is six hours. Overall dimensions of the machine are span 46 ft. length 36 ft 9 in, and height 17 ft. 4 in

The year 1930 saw type "Chiang Hung," a two seat training or three-seat touring biplane The "Chiang Hung" is a single-bay biplane with wooden wing structure, wire bracing, and fabric covering Ailerons are fitted on bottom panels only Interplane struts are steel tubes with wood fairings Means are provided on the top center section for hoisting aboard ships

The fuselage is rectangular in section with wooden structure covered with fabric The engine mounting and forward portion of fuselage are of steel tubing

A monoplane type tail unit with braced three-ply tail plane and cantilever fin is employed The stabilizer is adjustable in flight Rudder and elevators are unbalanced Wood structure and fabric covering are used

The Chiang Hung has twin floats, with single steps and chassis consisting of outwardly sloping "N" struts to the floats. The floats are connected together by two spreaders which are supported midway by the apices of transverse Vs from the fuselage The spreaders are further cross-braced with cables All the float struts are steel tubes faired with wood Floats are constructed of wood, with five watertight compartments, each having a hand-hole.

The 165-hp Wright 'Whirlwind" five-cylinder air-cooled engine is supplied with fuel from two tanks on top of the center section

Side-by-side seats are provided in the front cockpit below the wing and the rear cockpit is behind the trailing edge Dual control is provided in the front cockpit When the machine is used for touring the rear cockpit can easily be converted into a luggage compartment with a detachable cover

The upper wing span is 34 ft 7 in, and that of the lower 35 ft 8 in The chord of both wings is 5 ft 3 in, and the gap 5 ft 3 in Overall length is 27 ft. 4 in, height 11 ft 8 in, and wing area 338 sq ft

The weight empty is 1,630 lb, disposable load 2,600 lb, wing loading 7 7 lb per sq ft, power loading 15 75 lb per hp

Maximum speed is given as 110 m p h landing speed, 53 m p h , initial rate-of climb, 514 ft per min , climb to 10,000 ft 31 minutes, and absolute ceiling, 15,500 ft

Type "Chiang Hau"

Similar to the "Chiang Hung" is type "Chiang Hau" powered with a Wright "Whirlwind" J-6-5 165 hp at 2,000 r.p.m Its performance with full load is high speed, 118 m p.h, cruising speed 97 m p.h. landing speed, 56 m p h., rate-of-climb at sea-level, 450 ft per min , climb in 10 min , 3,770 ft , and service ceiling, 9,620 ft

The length overall is 27 ft. 0 in., and the wing span 32 ft 2 in

The weight empty is 1,660 lb and the gross weight 2 260 lb Equipment includes a metal adjustable pitch propeller 8 ft 6 in in diameter.

In February, 1931, the N A E was moved to Lungwha, Shanghai Capt Y K Tseng is Director-General of the reorganized Naval Air Establishment

Because it has religiously kept out of politics the N A E has weathered and survived a number of revolutions and the downfall of several different governments. Its development, however, has been hindered by the paucity of available funds

Although the Naval Air Establishment has progressed beyond all other manufacturing institutions in China in the application of home products and native materials to aircraft construction, there are other factories whose interests are confined to building aircraft of foreign materials and to repair work Of these the most important is the one at Canton, South China, which has a floor area of 72,000 sq ft, in three main buildings divided into woodworking, doping, machine shop, welding, engine overhaul, and drafting departments, and equipped with tools of German and American manufacture The personnel is exclusively Chinese but the director, Colonel Mui Lung On, is an American citizen, born in San Francisco, educated in Chicago, and formerly associated with E M Laird

Before 1927, when the present directors took charge, the Canton factory was used exclusively for rebuilding, overhauling, and repairing but since then more than a score of machines have been designed and constructed, most of them conventional biplanes of the light bombardment (observation) or training types, equipped with American or European engines One of the recent orders filled by this factory was for six light bombardment machines somewhat similar to but smaller than the Vought Corsair and powered with Pratt and Whitney Wasp engines With a gross weight of 2,500 lb., a weight empty of 1,600 lb, and a fuel capacity of 140 U. S gallons of gasoline, these machines carry four 50 lb. bombs, a fixed machine gun on the upper right wing and a flexible gun aft

A single seater pursuit type of plane with a 300-hp Wright Whirlwind nine-cylinder engine, and reported to have exceedingly high performance, also has been built Both of these planes have aluminum alloy tube fuselage construction The wings of the observation ship have wooden spars and ribs while those of the pursuit ship have spars of rectangular section duralumin tubing Welded steel tube construction is used sparingly because of the high cost of importation of materials for oxy acetylene welding.

There is a definite desire on the part of the director for standardization and a distinct preference for the more simple American types of construction

Recently, the Curtiss-Wright Interests have effected a deal with the Chinese National Government, and are at work establishing a factory for the manufacture of American-type aircraft. This, however, will not interfere with the N A E., whose primary purpose is research and experimentation with Chinese raw materials for use in aircraft construction

Inter-city bus maintenance practices hold a valuable lesson for airline operators

A Matter of Precedent

By

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and

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THERE has been a not altogether unnatural tendency for laborers in the aviation vineyard to consider themselves a people set apart, explorers of fresh fields without benefit of prior experience from mere groundlings The idea of flying has been in itself so revolutionary for the human animal, that it has carried with it a feeling that all aspects of the science must be totally new and unrelated to any other field of endeavor Now that commercial aviation has gotten its feet on the ground (to use a slightly back-handed metaphor), it has begun to see itself in proper perspective as an integral part of the general transportation picture It can well afford to doff the high hat and look to some of its contemporaries for ideas that may be applied to its particular problems

Railroads, trolley systems and even steamship lines have already contributed certain valuable lessons in the fields of passenger solicitation, express carriage, and traffic handling When it comes to operations in general and maintenance in particular, however, a parallel which exists between the great network of intercity bus lines and the airlines becomes obvious from a casual inspection and of considerable significance when analyzed in detail Except for the fact that airplanes travel in three dimensions and buses in two, the essential differences between the two are not very great. The units are comparable in size and capacity they depend for their propulsion on essentially the same mechanism, the internal combustion engine, the materials which enter into their construction are similar, and many of their parts are essentially alike Unlike railroads and trolley systems, there are no problems concerning right of way Terminal and intermediate stations are very similar, and in general perform about the same functions The parallelism, however, is particularly striking in the maintenance departments. The services which must be performed to keep the units in operating condition are essentially the same Tires and brakes must be serviced; storage batteries changed and charged; electric lighting systems checked; heating and ventilating units kept in good working order bodies and cabins kept clean and sanitary valves ground control mechanism adjusted, and, in short, a hundred and one jobs that must be done periodically to insure continuous and safe operation are in the same general category There is no more striking evidence of similarity than the discussions that take place at conferences of maintenance men in both fields. Much of the time in such meetings it would be difficult for a visitor to detect whether the program was concerned with airplanes or buses. By and large, the similarity is so marked that it is well worth any airline operator's time to look to the bus field for new ideas

Buses emerge

Bus operation in America is comparatively new but it antedated real commercial airline development by six or seven years. In the early 1920's a great many people were attracted by the idea that money could be made from bus services and many a jitney operator decided almost overnight to enter the field They were, for the most part, untrained both in transportation problems and in business and the net result was an extremely chaotic condition which caused the railroad and transit men of the period (who had feared that the new form of transportation would offer considerable competition) to rub their hands in unholy glee It seemed to them that the infant industry could not long survive. Its mushroom-like growth is well illustrated by the fact that between 1922 and 1924 more than 5,000 bus companies came into existence. Most of them operated on a small scale, in majority of cases simply as a one-man business, but it was good news for the equipment manufacturers however, who sold many millions of dollars worth of buses and accessories, mostly on a monthly payment plan By 1925 well over $100,000,000 worth of equipment had been put into service

It did not take long for most of the small operators to discover that they were losing money at a more rapid rate than they had calculated their potential gains Most of them had evidently figured that buses would run indefinitely if kept supplied with gas, oil and tires, and there was very little attention paid to maintenance of any kind Road failures became frequent, and services irregular, and the public began to desert the new form of transportation in favor of the established railroad and trolley lines.

Analysis of the situation soon indicated that the major trouble was occurring in the maintenance departments Most bus operators lacked knowledge of organized maintenance procedure or of efficient shop methods and practices. Buses were being patched up only after they had failed in service, and the facilities available for servicing and repair both with respect to building, tools and personnel were of the sketchiest nature Accounting practices wera very crude, and, in general, their only common attribute was a failure to reveal anything as to the true conditions of operating or maintenance costs. On the average, operations costs exceeded income by 1 or 2 cents a mile, with maintenance costs running in excess of 7 cents a mile A relatively small reduction in maintenance costs therefore, could easily make the difference between red and black ink on the earning statement. There were little or no efforts toward co operation, no interchange of essential information There was no attempt to build up a uniform system of accounting which would give some standards of comparison of maintenance efficiency It was a case of every man for himself.

Not so today That the entire industry did not founder in a sea of high maintenance costs is due in no small degree to a campaign instituted in 1925 by *Bus Transportation* to create an appreciation of the importance of maintenance and to develop and perfect uniform maintenance practices and methods Fortunately operators and manufacturers were not slow in realizing the essential soundness of the argument and today the major bus lines are operated at a degree of efficiency which may well serve as a pattern for those interested in maintenance of equipment in the aviation field. No longer does each operator work in the dark, developing independently his solution to problems which are common to all It has been recognized that the common good is served by giving the widest possible circulation to information concerning tooling, methods and costs In all these matters it has been proven to the entire satisfaction of all concerned that there is more to be gained through co-operation than from drawing the veil of secrecy about matters that might reasonably be considered as private

Why not discuss costs?

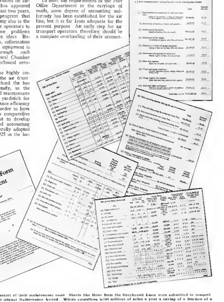
Fortunately, the maintenance picture in the air transport industry of today is not comparable to the early chaotic state of the bus companies Operators generally have passed through the period of hit-or-miss maintenance and have long since adopted the philosophy of preventative maintenance—that is, taking care of trouble before it happens A study of the series of articles on airline maintenance which has appeared in these pages during the last two years, indicates the enormous progress that has been made. Encouraging also is the increasing desire of airline operators to discuss their maintenance problems openly and to interchange ideas Besides periodic conferences, information on new methods and new equipment is being interchanged through such agencies as the Aeronautical Chamber of Commerce, and the technical aeronautical press

So far so good In one highly important aspect, however, the air transport industry lags far behind the bus transportation group, namely, in the free and open discussion of maintenance costs The only practical yardstick for the comparison of maintenance efficiency is one based on cost In order to have costs mean anything on a comparative basis it is necessary first to develop some sort of standardized accounting system which can be generally adopted by the industry Up to 1925 in the bus industry there were as many different accounting systems as there were companies It was no small problem, then, to develop a single accounting procedure which would meet the requirements of all companies and yet reveal detailed classified costs which could be compared directly Again under the leadership of *Bus Transportation*, a standardized system of cost accounting for bus operations was evolved which today has been generally adopted.

Uniform accounting needed

To meet the requirements of the Post Office Department in the carriage of mails, some degree of accounting uniformity has been established for the air line, but it is far from adequate for the present purpose An early step for air transport operators therefore should be a complete overhauling of their accounting practices,—and an agreement on some sort of uniform procedure

Today, based on the standard accounting procedure, the major bus lines of the country compete annually for *Bus Transportation's* Maintenance Award The purpose of the Maintenance Awards is to stimulate and encourage the rapid dissemination of information



Bus line operators make no secret of their maintenance costs Sheets like these from the Greyhound Lines were submitted in competition for *Bus Transportation's* annual Maintenance Award Where operations total millions of miles a year a saving of a fraction of a cent per mile on any single item of maintenance expense makes a very impressive showing in the aggregate

on new and improved methods so that the industry may profit through cumulative experience, and in so doing, advance more swiftly the progress of the art of maintenance. A great many bus companies enter this contest largely because it affords them an excellent opportunity to put in concrete form, perhaps for the first time, a complete outline of their maintenance system Such self-imposed studies have proved of great value to the contestants by pointing out weaknesses in their systems which became apparent only when they tried to relate their methods in written form Contestants are required to submit a complete outline of their year's operations, showing all of their operating and maintenance costs broken down in great detail This material is not submitted as confidential information, but is available for complete publication The questionnaires which are submitted are sixteen-page booklets containing blanks to be filled in under some 300 numbered heads To show to what extent the information is released, several pages taken from the brief submitted by the Greyhound Company for the Maintenance Award Contest for 1933 are reproduced herewith This does not represent an isolated case It was submitted by one of the largest bus operators in the country along with similar statements from many other companies whose operations cover all parts of the United States Obviously the bus companies make no mystery of their operating and maintenance costs.

Cost competition

And what of it? What is there to be gained by broadcasting figures which might normally be considered as confidential? The keenest sort of competition exists among the several companies on the basis of their published maintenance costs. Thus, if the Super-Super Stage Lines of West Texas show that their chassis maintenance costs are in the neighborhood of 1½ cents a mile, and Mr Joe Zilch of the X Y Z Bus Lines knows that his chassis are costing him 1½ cents a mile, Mr Zilch immediately grts to work to find out "how come," and before long his cost is down to 1 cent When this comes to the ears of the maintenance boss of Super Super, he finds ways to do the same job for 9 cents per mile for the next year,—and so it goes Competition of this sort has been going on for the last five or six years in the bus field and has been reflected in steadily reducing overall maintenance costs A large New England fleet, for example, operating an average of 5,000,000 miles a year has shown the following reduction in overall maintenance costs in cents per mile 1929—12.7, 1930—9.9, 1931—8.8, 1932—8.1, 1933—7.2, and for the first quarter of 1934—6.5 Results like these more than justify years of effort and the fullest co-operation and interchange of essential information.

Clearly then, in the field of maintenance, airline operators cannot feel that they are working entirely without benefit of precedent A great deal of progress has been made but there is yet much of value that can be learned from a study of methods evolved by the bus people Although bus operation is the prior art and has some five or six years more experience behind it, it is not impossible, too, that the bus men might find it well to their advantage to visit some of the great overhaul and repair stations which the airlines have built up at such points as Chicago and Kansas City Both groups need and should seek the benefits of industry co-operation and of general free interchange of reports on new methods and vital statistics

Radio Antennas and High Speed Ships

ON 120-m p h airplanes the radio antenna is not much of a problem, aerodynamically speaking Within reasonable limits it is possible to erect masts and drape wires and insulators without any serious effect on the top speed of the ship. With cruising speeds jumping into the 150-200-m p h range, however, the problem becomes much more serious and differences in speed with or without projecting antennas are easily measured. Practically every airline now operating fast planes is experimenting with the problem United Air Lines, for example, found that the speed of the Boeing 247 transport was raised by 4 m p h simply by eliminating the original mast and substituting a V-shaped antenna supported on three short horns mounted on top of the fuselage Two of the horns are located just above the rear cabin bulkhead the third is mounted just over the pilot's cockpit A short lead-in wire connects the antenna with the radio apparatus in the nose of the ship. This takes care of two-way communication requirements. A short vee antenna under the nose (supported on the pitot head bracket) is used for beacon reception

Several of the airlines are experimenting with the trailing wire type of antenna The old idea of paying out a wire with a weight on the end of it (so that it would dangle below the ship) has been abandoned in favor of an unweighted wire which trails directly astern in the line of flight Most designs contemplate passing the antenna through an insulated fair-lead in the tip of the tail cone of the ship.

A number of interesting mechanical problems are involved in the design of remote controlled reels for paying out and hauling in the proper amounts of wire It is obviously possible to adjust the transmitting frequency of the plane's radio by using various predetermined lengths of aerial wire What is needed is an automatic device which will pay out the correct amount under push button control from the cockpit.

As a matter of fact the current trend seems to be in favor of forgetting about reels entirely and simply letting the antenna trail freely both in the air and on the ground The attachment fittings in the tail cone are being designed to break at a tension in the neighborhood of 60 to 75 lb to eliminate any likelihood of damage in the remote event that the trailing wire fouls any object on the ground when the ship is moving Since it is obviously impossible to conduct the ordinary checking of frequencies when ships are standing on the apron before scheduled departures with antennas trailing on the ground, dummy antennas have been developed in the form of compact condenser units which may be plugged into the fitting in place of the trailing wire Such devices are quite satisfactory for very short-range testing, but are of no particular use for emergency transmission and reception after forced landing in remote locations For such cases, however, a light (1½ lb) aluminum mast has been developed to be carried on board ship which may be inserted into the ground as a support for the free end of the trailing wire With this arrangement emergency contacts may be maintained over relatively long distances

Another aspect of the problem involves the control of whipping of the wire trailing astern. Whipping has no noticeable aerodynamic effect, but it has a very serious mechanical effect upon the antenna itself Even after relatively short flights, the continual reversal of stresses near the end of the wire causes rapid strain hardening and consequent breakage Phosphor bronze cables which are perfectly ductile to begin with, become brittle enough to snap off like a dry twig after flights of relatively short duration

The great increase in transmitting efficiency which accompanies the use of the trailing wire antenna is a sufficient reason for prolonged and continual research to solve the purely mechanical problems In the very short antenna system now carried by many modern transports, it is impossible to realize more than 10 to 15 watts actual output from a 50-watt transmitter With a trailing wire 70 to 75 ft long, however, it is easily possible to put from 45 to 50 watts into the antenna system

Wright Field investigates the problem of propeller blade failures due to resonant vibration

A Study of Propeller Vibration

By H. H. Couch
First Lieutenant, Air Corps

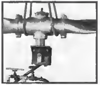


Fig 1: The test set-up involved the use of a rotating eccentric weight which was driven by a small air motor

Fig 2: Wood dust or sand was spread over the blades and when a resonant vibration frequency was reached, practically all of the dust worked off except a narrow band at the stationary nodal points The three nodal points can be seen on this 11 ft 5 in diameter aluminum alloy propeller, vibrated at a period of 7 300 v.p m

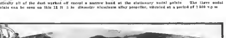


Fig 3: Torsional vibration is indicated by the dust band on this propeller which was of the same dimensions and material as that of Fig. 2. The vibration period was 15 000 v p m

REPEATED failures both in military and commercial service of metal propellers built from materials the endurance limits of which were well above the stresses computed for them under operating conditions, caused the Material Division recently to inaugurate an intensive program of research into the problem with the hope of arriving at an explanation of the incongruity and thus be enabled to prevent future failures

This problem presented something of a puzzle. For example, aluminum alloy propellers had failed in which the endurance limit at the point of failure had been 10 000 lb per sq in. and the computed operating stresses 4,000 lb per sq in. Hollow steel propellers likewise, with an endurance limit of 55 000 lb per sq in. at the point of failure had failed at computed stresses of 30 000 lb per sq in Since the problem was clearly not one of simple stresses, it was determined to study the types of vibration possible in aircraft propellers to learn whether vibration was responsible for the failures. Although the research program is by no means completed, it has progressed to the point where prediction of failure has been accomplished by location of nodal or non-vibrating sections of the propeller blades and by determination of the resonant vibration frequency of the propeller

The propeller can be considered as a tapered twisted beam made up of thin airfoil sections The blade deflects easily about a neutral axis that is almost parallel to the chord of the air foil section and is very rigid about an axis at right angles to the neutral axis For the excitation of vibration in the propellers tested the assembly propeller was suspended in a pair of shock absorber cords of such elasticity that a low natural frequency would result A rotating eccentric weight driven by a

small air motor was mounted on the front of the propeller hub so that the plane of rotation of the weight passed through the center line of the propeller blade The speed of the air motor was gradually increased until violent vibration resulted

Blade action under vibration

The action of the propeller blades under the vibrating forces at various frequencies was found to be similar to the vibration of reeds. The tips showed a large amplitude, and certain stations or nodes on the blades were found to be practically stationary The position of the nodes was found by shaking fine wood dust or sand on the blades. When a resonant vibration frequency was reached, practically all of the dust worked off the blades except at the stationary nodal points where a narrow band of dust remained The nodal points, or locations in their vicinity, are points of maximum stress in the blade under vibration and will be places at which the propeller will fail if the vibration stresses plus the normal stresses exceed the endurance limit of the material. That portion of the blade between two nodes where there was great amplitude of vibration is referred to as a loop

A torsional type of vibration is produced by mounting the rotating eccentric weight on the front of the hub so that the plane of the rotating weight is at right angles to the center line of the propeller blade This type of vibration, which produces a dust line down the center of the face of the blade, is responsible for no known propeller failures to date

Failures in flight

Sixteen blade failures, including six different propeller designs, which occurred in the operation of military and commercial aircraft were studied Six of the blades cracked near the 29½ in station in flight (near the second node from the tip) at between 150 and 180 hours flying time The planes were generally flown with wide open throttle and the particular propeller employed was operating at a resonant frequency at this throttle setting

Of the sixteen failures, twelve were due to the excitation of the resonant vibration frequencies of the propeller by the engine explosions and four were due to resonant frequencies excited at cruising speed by the proximity of the blade to wheel pants Some of the failures were hastened by stone bruises obtained during warming-up and take-off at the points of maximum stress It is possible to have failure at any one of the nodes on the blade Most of the failures in service have occurred at some one of the nodes for the three-node-per-blade type of vibration

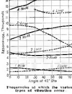
Besides the sixteen propellers which failed in flight, two failures were produced by the rotating eccentric weight with the propellers suspended in a sling One failure was produced with a two-node-per blade type of vibration Complete failure occurred after one hour and ten minutes of operating at a resonant frequency The other failure was produced with a three-node-per-blade type of vibration A pronounced crack developed after 25 min of operation, complete failure occurred after seven hr 27 min The failure was a duplicate of one which was produced after 110 hr flying time The two fractures that occurred with the propeller suspended in a sling were located just inside the node nearest the tip

In all, there were found to be three types of vibration possible in a propeller (*a*) with a loop at the center line of the propeller hub, (*b*) with a node at the center line of the propeller hub, (*c*) torsional type with node along the center line of the propeller blade

In all types of vibration with a loop at the center line of the propeller hub both blade tips will move up and down at the same time, in an action similar to that of a bird flapping its wings By connecting an electric lamp in series with a battery and holding the ends of the wire so that both blades make contact on the up stroke, the current will pass through the blade and light the lamp once during each cycle of vibration when the blades are on the upper half of the stroke.

In all types of vibration with the node at the center line of the propeller hub, and one or more nodes per blade, one tip will move up while the other tip moves down To test for a node at the center line of the propeller hub, one contact of the electric light circuit is held on the face side of the blade and the other contact on the cambered side near the tip If the node is at the center line of the hub a circuit breaker effect will be produced which will light the electric lamp

As the speed of the rotating eccentric



Frequencies at which the various types of vibration occur

weight is increased, resonant vibration frequencies will be produced which will have two nodes per blade, three nodes per blade, etc., but under all conditions the test for loop or node at the center line of the blade is determined by the electric light method That the sand or wood dust works about some nodes in a clockwise direction and about others in a counter clockwise direction is accounted for by the twisting action of the blades at the nodes

Effect of blade angle

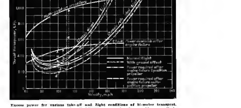
The values of resonant frequencies change with the change at blade angle, as shown in the curves herewith reproduced The designation "three-loop" signifies a type of vibration with three nodes per blade with a loop at the center line of the propeller blade The designation "three-node" signifies a type of vibration with three nodes per blade with a node at the center line of the propeller hub Cases were found where the propeller successfully passed the engine test on the ground where the blade angle was low and the blade was not running at resonant frequency, whereas at the high angle used in flight the propellers were running under resonant vibration frequency conditions and failures occurred

When the propeller is rotating on the engine the centrifugal force on the blades raises the resonant frequencies to some extent For the single-node condition the increase is material; for the two-node-per-blade condition, it is somewhat less; and for the three-node-per-blade condition, only slight. A study is being made to determine the exact amount that these resonant frequencies increase in flight due to the speed of rotation of the propeller

New types should be studied

With the information gathered through the tests to date, it would seem to be the better part of wisdom to study all blades of new or radical design for resonant frequencies before the final finishing cut is made on the blades If the original design is found to have resonant vibration frequencies which will be excited by engine explosions within the flying range of engine speeds, alterations in the design can then be made to shift the resonant vibration outside the normal operating range.

An Air Corps Information Circular containing a study of the vibration problem and a standard method of obtaining the resonant vibration frequencies has been furnished to the leading manufacturers of metal propellers, and is being used at the present time in the production of new propellers A study is also being made to determine the frequencies of propeller blades in service in the Air Corps All those having resonant frequencies at cruising speed will be altered or replaced



Excess power for various take-off and flight conditions of bi-motor transport. (A) Maximum excess power for climbing on one engine (two-position propeller). (B) Maximum excess power for climbing on one engine (multi-position propeller). (C) Maximum excess power for climbing on both engines. (D) Optimum configuration at each point during take-off up to speed of best climb—and, if engine failure occurs,—beyond this instant, to "B" or "A".

Engine Failure at Take-off

By Edmund T. Allen

With the current trend decidedly in the direction of the twin-engined transport it is time for a review of the age-old question of what to do when an engine stops, particularly under the critical conditions of take-off Mr Allen, whose contributions are already well known to AVIATION readers, furnishes the answers based on theoretical considerations and wide experience as a test pilot. His treatment demands the closest attention from engineers, but also, and most particularly, from pilots.

THE RECENT simultaneous appearance of several new twin-engined transport airplanes has led to a new examination of the basic grounds for the exclusive concentration on the twin-engined type by leading American transport operators Every new trend in design is usually supported by exaggerated enthusiasms and is resisted by bitter counter-enthusiasms. If the future holds a prospect of improved designs and development along a particular line, it is well worth while examining closely some of the claims to superiority on both sides

The passing of the tri-motor as a type has been repeatedly predicted on the ground that it is less efficient and less suitable for passenger transport than the bi-motor This view, however, has not been universally accepted The tri-motor designers find their principle argument in the question of safety in the event of a motor failure on take-off The tri-motor, they argue, has, after engine failure, two motors remaining, or two-thirds of its total horsepower, to pull it out of its difficulty, while the bi-motor has only one-half its horsepower in this emergency In examining this argument, the first point to be considered is the relative probability of engine failure on the two types of airplanes On a purely statistical basis, the tri-motor is more likely to suffer engine failure in the ratio of at best 3 to 2 To begin with then, there is a 50 per cent greater danger on take-off with the tri-motor than with the bi-motor If we assume that an average figure for engine miles per engine failure is 300,000 on regular transport operation and that take-offs occur on the average of every 200 miles, we should expect an engine failure during the initial mile after take-off once every 60,000,000 take-offs per engine. This is not strictly accurate however, because engine stress, usually the criterion for engine failure, is much greater on take-off than in normal cruising flight If full rated power is used on take-off and 75 per cent power is used in cruising, we may assume that take-off induces ten times greater liability to engine failure than cruising in which case our figure for engine failure per take-off would reduce to 6,000,000 per engine This would give three million take-offs per engine failure on a bi-motor and two million on a tri-motor Most engine failures on take-off are not however, caused by over straining the engine, but are due to some of the causes connected with initial running of the engines, such as faulty carburetion, which has not yet become stabilized at engine operating temperatures, faulty fuel system, or faulty lubrication One transport line

found from their statistics that 90 per cent of their engine failures for a given period occurred within the first ten minutes of take-off.

These statistics will hold for the bi-motor or the tri-motor airplane equally well, bearing in mind that the figures are per engine, not per airplane. It is in the consideration of the relative hazard of the two types after engine failures on take-off that we could expect significant differences.

In analyzing the problem for the pilot, the most important consideration is the exact position at which engine failure occurs during take off. If it occurs during the initial part of the take-off run, the pilot will most certainly close the throttles and bring the airplane to a stop. There comes a time, however, during take-off when this is no longer possible because the length of the runway does not permit landing straight ahead. On most American airports, one-half the length of the runway is considered the point beyond which it is impossible safely to attempt a landing in case of engine failure. The pilot must, at this point, attempt to continue flight on his remaining horsepower. That this is possible on all present-day tri-motors with one engine stopped is a fiction subscribed to by most tri-motor enthusiasts. Control at take-off speeds is sometimes the determining factor in such a performance. Sometimes it is simple lack of thrust horsepower available at take-off speeds which spells disaster in this case.

Take-off procedure

There is a certain technique in making every take-off which always provides the maximum safety at every point during the initial climbing period. Taking into account the fact that the probability of engine failure is far greater on take-off than at any other like period of time during flying, the efficient pilot will utilize every precaution to see that the fuel system is properly working before take-off, that carburetion will be smoothly continuous during the sudden application of full engine load, and that the lubricating system will be given every chance to function perfectly. He will start from the extreme end of the runway. He will not use flaps because he desires to reduce drag to a minimum even at the expense of lift. He will operate the engines during the initial part of the take-off run at, but not beyond, the engine manufacturer's recommended limitations. His object during the take-off will be to accelerate as rapidly as possible up to the "air speed of best climbing rate on one engine" (See the figure on page 181.) This point is his marginal critical take-off point beyond which it will be possible to continue climbing on one engine. It is desirable to accelerate slightly beyond the marginal air speed and up to the air speed of best climbing rate on both engines. After the point has been passed beyond which a landing straight ahead can no longer be made safely, the pilot will retract his landing gear at once. He will then climb at the speed of best climbing rate, decreasing his engine power as soon as he has retracted the landing gear and as soon as he is climbing at the proper airspeed.

Dead engine technique

When engine failure does occur on take-off the technique which will give a maximum safety potentiality is as follows. If the engine failure occurs on the initial part of the take-off run before best single-engine climbing airspeed is reached, or if in any case there is still plenty of good landing area directly ahead on the runway, the throttle should be closed and the flight discontinued. It is very easy to guide the entire take-off procedure from this point of view by means of the airspeed indicator, thus should always be the criterion for deciding whether to continue take off or to throttle the remaining engines. The airspeed indication is independent of the altitude of the take-off airport and so it will be a reliable guide at any altitude. If engine fails after the critical point is reached where discontinuance of take-off is no longer safe, the landing gear should be immediately retracted (if not already in) since, in any case, the landing gear will do more harm than good. Landing any modern transport on any rough terrain is probably safer with the wheels retracted than extended.

The best control and best conservation of engine power is secured after engine failure by flying straight ahead and nearly level laterally rather than by allowing the airplane to turn or bank with the unbalanced torque. A slight advantage in drag is obtainable by flying with zero yaw rather than with zero bank. On most bi-motored airplanes, zero yaw would be obtained in a very slight (1 to 3 deg.) side slip with the dead engine high. In any properly designed bi-motor airplane, it does not matter appreciably which engine has failed as far as the efficiency of continued flight is concerned.

Climbing after take-off

The question is frequently raised as to which of two alternate take-off procedures is the safer: (1) to climb as rapidly as possible at a low airspeed in order to gain altitude for maneuvering in the event of engine failure or (2) to hold the ship very close to the ground until considerable excess speed is attained with the maximum climbing rate can be realized. There can certainly be no point in accelerating to a higher airspeed than the airspeed of maximum climbing rate, but between these two alternatives there may be some question. Initial climbing at lower than optimum climbing airspeed and initial holding close to the ground to pick up excess airspeed give two different means of storing up energy useable in the moment after engine failure. In the first case, one stores potential energy of position or height which may be used in gliding flight; in the other case, kinetic energy of momentum which may be used after engine failure in slight zooming or temporarily continuing level flight at lower altitude and at decreasing airspeed. There is a significant difference, however, in the amount of such energy available at any given instant after the wheels have left the ground. Work done between these instants is proportional to engine revolutions, which are higher in the case of picking up excess speed than in climbing at very low speed. Power available is greater in the former case.

When one plots power-available and power-required against velocity one can readily see how inefficient is climb at lower than best climbing airspeed. (See the figure on page 181.) If one then adds to this chart a curve of power-required when in the ground-effect region, one can see how the excess power utilizable in climb varies as one pulls away from the ground effect. The transition from one to the other may be done in a manner which might seriously impair the safety of the climb. It may also be done in such a manner that the maximum excess energy is always available for climbing. Translated into the terms which the pilot normally uses, take-off and climb are best accomplished by holding the airplane close to the ground until it reaches best climbing airspeed for the case of the ground-effect region. This will be slightly in excess of best climbing airspeed for normal flight. Thus, if engine failure occurs during the transition from ground-effect to normal flight, airspeed will drop in the proper manner. There is nothing to be gained (except possibly from a distance-covering viewpoint) in climbing at any higher speed than optimum climbing airspeed, and there is definitely a loss in climbing at any lower airspeed.

The difference between take-off with a single-engined airplane and with a multi-engined airplane here concerns the very fundamentals of intelligent multi-engined design. Take-off in a single-engined airplane is most safely accomplished in such a manner that, should engine failure occur after the critical point is passed, the airplane will have a maximum of potential energy of position from which to choose and glide safely to the best landing spot in the vicinity of the airport. The multi-engined airplane, on the other hand, is taken off with the object of continuing flight on the remaining power should one engine fail. Its optimum condition then in the critical period is one which makes it most capable of continued climbing with the least possible power.

Thrust or brake horsepower?

The difference between two-engined and three-engined airplanes with respect to optimum take-off technique is slight. With controllable propellers on the twin-engined airplane, the thrust horsepower is approximately the same in this emergency as the thrust horsepower available on the tri-motor with fixed pitch propellers. In comparing the tri-motor with the bi-motor it is necessary, however, to compare equal excellence of design in providing maximum safety for emergencies. This is often overlooked in comparing obsolete tri-motors with scientifically designed bi-motors. Even the tri-motor enthusiasts fall obliquely into this error in pointing to the "need of supercharged engines and controllable propellers" on the bi-motor in order to equal the tri-motor. While guarding against the error of comparing obsolete with current design, we must also guard against an equally erroneous tendency of giving the credit for bi-motored performance to the wrong factors and thus disposing of excellence which, on a fairer view of the merits of the two, cannot be disposed of so easily. Certainly we cannot fairly compare a bi-motor having supercharged engines to a tri-motor without supercharged engines. Supercharged engines are a necessity on any modern transport in order to make use of the economies of high altitude cruising after the manner made explicit in a series of articles in AVIATION as the Optimum Cruising Altitude concept. The comparison has occasionally been made of the bi-motor with controllable propellers to the tri-motor without controllables (to the detriment of the former), by showing that there is more horsepower available with the fixed pitch tri-motor whose one engine has failed than with the controllable-pitch bi-motor in a similar emergency. If we examine this argument, we find that it is brake horsepower which has been considered and not thrust horsepower. It is only thrust horsepower which can assist the pilot in getting out of a predicament like engine failure on take off.

The following table is illuminating in showing just what happens on take-off when one engine fails on the two types in question. The assumption was made that the controllable propellers are set for take off at a pitch which will permit full power at the point during take-off run when the airplane has reached the critical region, one half the length of the runway, and has accelerated up to its best climbing airspeed. This assumption is reasonable for all modern design. The further assumptions were made of 80 per cent propeller efficiency at full revolutions and 73 per cent propeller efficiency at 80 per cent power, and at the 93⅓ per cent of full revolutions available at climbing speed on a fixed pitch propeller.

Per cent power available with all engines working.

	Fixed-Pitch Propeller		Controllable Propeller	
	Bi-motor	Tri-motor	Bi-motor	Tri-motor
bhp.	80	80	100	100
thp.	58	58	80	80

Per cent power available after one engine has failed during take-off

	Fixed-Pitch Propeller		Controllable Propeller	
	Bi-motor	Tri-motor	Bi-motor	Tri-motor
bhp.	40	53.3	50	66.6
thp.	28	39	40	53.3

The principal revelation comes in the last line of the table showing thrust horsepower available at the moment of engine failure. The controllable propeller installation on the bi-motor gives 40 per cent with one remaining engine, while the tri-motor with fixed pitch gives only 39 per cent with its two remaining engines. It has been argued by the tri-motor builders that it is necessary to have controllable propellers on the bi-motor in order to equal the fixed propeller tri-motor in this emergency. As an argument for carrying along an extra motor as over against equipping the airplane with controllable propellers, the position is untenable on either a cost, maintenance, weight, or cruising speed basis.

Controllable propellers necessary

It should be pointed out perhaps that for ultra-modern airplane design of the wing and power-loadings required to achieve what is now possible in the way of efficiency and weight-speed performance, controllable propellers are a necessity for take off, whether the airplane is a bi-motor or a tri-motor.

In the course of a study of take-off behavior with one engine going dead undertaken during the testing of a recent bi-motor transport, the airport at Winslow, Arizona, was selected as offering about the most severe conditions that could be found. It is 4,500 ft. above sea level, and the temperature is almost always above standard, so that the standard-density altitude at the time of the test was 5,100 ft. On the day of the test, there was a 4 m.p.h. wind, making it necessary to take-off up hill toward some cliffs, making a turn necessary soon after take-off. Lines were made with lime on the gravel runway at intervals of 1,800, 2,000 and 2,200 ft. from the start of the take-off run to guide the various operations necessary before cutting one engine. Multi-position, controllable propellers were not available although they would have given better results than the two-position type because of the possibility of reducing the great drag of the idling propeller by feathering it. The airplane was warmed up as usual, taxied to the end of the runway and the take-off begun. The take-off technique, determined upon from the above study, was followed with no attempt to get away from ground effect until the proper airspeed had been attained. At the 2,200-ft. marker, with the airplane not over 2 ft. from the ground, one throttle was jerked completely closed, the landing gear was retracted, and the airplane was held at its best climbing airspeed while it climbed 1,000 ft. above the take-off point with full gross load aboard. The operating engine was not opened up beyond its rated power but was operated throttled,—at 85 per cent power when the initial 1,000 ft. climb was completed, and at 75 per cent during the major portion of the flight to Albuquerque, 240 miles away.

This take-off itself was undertaken with a view to testing the technique for achieving maximum safety in the event of engine failure, an ever present emergency at take-off. The mere fact that the airplane design is theoretically capable of continuing the take-off and climb on one engine is not sufficient. Mode of operation is quite as essential in this emergency as design efficiency. The capability of the airplane to accomplish this feat would not guarantee safety if practical operation were attempted without a feeling on the part of the pilot for the optimum relationship of power-available and power-required under the constantly varying conditions of take-off.

Floating hangar

BESIDES all the hangars and slip ways which are used for housing and operating aircraft and which are designed by the officers of the Chinese Naval Air Establishment (see the article beginning on page 172 of this issue), is a steel floating hangar which is unique in the fact that it is the only one of its kind in the world was constructed at the Kiangnan Dock and Engineering Works in 1922. It was designed by Captains Barr and Wong on the principle of floating docks and was for use on the Yangtsze River.

When it is desired to operate the seaplane, water is pumped into the flooding compartment and the hull is sunk to its low waterline; a flap door is then opened and the machine is water borne and hence can easily be taxied out. Sinking or floating of the hangar is accomplished by means of a centrifugal pump which is driven by a kerosene engine.

Overall dimensions of the floating hangar are: length 70 ft. 8 in., width 35 ft. 4 in., and height 26 ft. 6 in. Its normal draft is 2 ft. 10 in.

E D I T O R I A L S

AVIATION

EDWARD P. WARNER, *Editor*

Fixed-Base Blue Eagle

A GENTLEMAN who shall be nameless, as he shrinks from personal publicity, runs a small airport and flying service in the outskirts of a thriving little city. His flying service, too, has thrived upon the whole. Its owner has always insisted that his fundamental concern was to have good equipment and keep it in proper condition and to find competent personnel to operate it. He has maintained his self respect and the respect of his community, and he has had a steady flow of business from young people (and their parents) bent on learning to fly, from citizens anxious to get somewhere in a hurry and unable to fit their itinerary to the regular airline schedules, from people finally smitten with the conviction that they ought to see what the earth looks like from overhead and willing to pay a couple of dollars for the privilege, and from those having need of a miscellany of other aeronautical services such as the making of photographs and the staging of advertising stunts of various sorts. The operator of the service, himself a pilot of long standing has been enough of a business man to insist on knowing what it would cost him to do a job before he undertook it, and then on being paid at least enough to cover the cost. He falls far short of the millionaire class, but he has made a modest living out of aviation, he has a rating with his bank, and he has been full of hope for a steadily brightening future.

But there is one cloud on his horizon. A few years ago another pilot acquired a much used plane at little cost, rented a temporarily disused 30-acre pasture by a highway, and stuck up a wind-sock and a sign proclaiming an airport. The newcomer was full of optimism, and empty of knowledge of accounting methods or of the organization of maintenance work on equipment. Quite arbitrarily, for no discoverable reason, he announced prices for hop flying and for instruction something below half those that had prevailed on the field already established. Since the money that came in had to be passed out again almost immediately for gas and oil and for the minimum living expenses of the pilot, maintenance was slighted and overhauls were postponed, and after about six months a crackup eliminated the airplane and closed down the operation.

In the meantime the fellow with the long established service suffered both directly and indirectly. He lost a substantial amount of business on prices that he refused to meet, for they were below any reasonably possible operating costs. He suffered a still larger indirect loss from the lowered reputation that aviation came to enjoy in that community and from the alarm that his competitor's final crash aroused. The operation of flying service, which had begun to be established in popular esteem as the responsible business of a responsible man, began to slip back by popular assignment into the category of half-baked carnival enterprises unworthy of the serious notice of serious people.

The effect of that experience was lived down in due course and the upgrade was resumed, but in another year or so another sanguine enthusiast came along and started up on his own account, and the cycle was repeated. The operator that had spent the last six or eight years in trying to build a reputation, not only for himself but for the business of which he is a part, and to educate his possible customers into a willingness to pay for flying service what it is really worth and what it really costs is getting a little fed up with having to cope with all this transitory and unstable competition.

THAT experience is the aggregate, in a somewhat simplified form, of essentially what a great many operators have suffered in the past few years. The essential circumstances are easy to recognize, and to parallel in almost any part of the country. Until a year ago one could give the responsible and experienced operator nothing but sympathy and the assurance that in course of time quality of service would make itself felt and the public would learn to stand by the man on whom they had learned that they could rely, but now it is possible to offer something more tangible. We now have the National Industrial Recovery Act.

It is for just such situations as we have described, for the control of irresponsible or unfair competition dependent upon price-cutting by operating at a loss or by clipping the quality of service, that the trade-practice provisions of NRA codes exist. Today the flying service operators can go to Washington through any agency representing a substantial proportion of their number—as, for specific example, the newly formed Independent Aviation Operators of the United States—and lay down a schedule of proper minimum rates for

flying service and minimum service conditions and ask that it be accepted as the law of the land. They can do away, so easily that one can hardly believe it, with whatever practices they themselves regard as abuses. They can make misrepresentation and exaggeration illegal. Stipulations can be made relative to the starting of new services in direct competition to those already existing, or services operating from fields notably inferior to other fields available and already in use in the same neighborhood. The chance of profit can be materially enlarged, and the general attitude of the leaders of business and finance towards local aircraft operations can be materially improved. It is only necessary for people in the business to decide that they want to make the effort, and to proclaim the fact to the leaders of their own organization.

NOTHING could have been done without an organization. Numerous attempts have been made in the past to get fixed-base operators together under one flag or another, and all of them have collapsed. Now it appears that one is succeeding, and that in itself is the best possible evidence of general realization of a need for organized activity. We suggest to America's aircraft operators that the next important task of their group is the drafting of a code of trade practice, with all necessary discriminations and differentials between localities, between large cities and small, and between various types of operation and of airplanes, and thereafter to submit it to the NRA and to press for the earliest possible approval and enforcement.

Piloting, A Profession

EVERYBODY whose experience goes back to the days of the War will recall that even at that early date the candidate for Air Service wings got under way with six weeks of ground school before he ever went near a flyable airplane. In that six weeks about three-quarters of the total time was consumed by matters that a military pilot must know but that are not piloting. Radio code practice, and bombing range periods, and the identification of matters of military interest from the air were the main occupations.

The cadet that goes to Randolph Field or Pensacola in 1934 finds himself still more involved in studies that seem only incidentally aeronautical. Piloting technique appears from the very beginning as only a part of his job, and before he gets through his course and goes to a squadron it may seem like only a comparatively minor part. And as with military aviation, so to a progressively greater extent with commercial flying as well.

THERE was a time in the beginning of air transport when a pilot's only real responsibilities were to know how to handle the controls superlatively well and to know his route. Meteorology and other sciences might be recognized as useful, and a knowledge of the engineering of the airplane and the engine was always a help but flying technique was first among the essentials and everything else was insignificant by comparison.

Time has changed all that. The transport pilot of 1934, to be really qualified for his job as it will develop over the next ten years, must have had the equivalent of a post-graduate technical education. It is not even enough for him to know instrument flying through fog and the use of radio and the interpretation of weather maps and signs. He has to understand the mechanism entrusted to him, the principles of its working, and the results of the tests that it has undergone to such an extent that he will be able not merely to use it safely in a routine fashion but to adapt his operation to changing circumstances so as to get the best possible results out of the equipment at every moment. The professional interests of an air line pilot as they stand today and as they are sure to develop in the near future call for a whole library of text-books, and there is going to be no place in the field for the man who thinks that piloting is a "practical business" and who scorns the help that the books could bring. Nor will there be any place for anyone who ever falls into the error of supposing that his education has been completed and that he has fully mastered his art. The articles of Allen and Oswald on the determination of cruising conditions and those of Kirchner on schedule-making and schedule keeping, all appearing in AVIATION within the past few months, are typical of the sort of material on which the man that plans to keep up with progress *must* keep up to date.

AIRPLANE pilots have been compared with everyone from taxicab drivers to captains of ocean liners. A great deal of nonsense has been talked about the impending lowering of the demands on the pilot and reduction of his work to simple routine by "robot pilots" and the like. Comparisons and sweeping conclusions are always dangerous, but if a comparison is to be made it is plainly the captain of an ocean-going vessel that most nearly corresponds to the pilot of a transport liner. The man in the cockpit has less executive responsibility than the man on the bridge, but his need for sound judgment is equally great and he has and almost inevitably will continue to have much more mechanical detail to take care of. He has to be not merely the commander of his ship, but to a large extent his own chief engineer, radio operator, and quartermaster. His complement of instruments approximates to and in some respects exceeds that of a 20,000-ton ship.

Quite apart from his technical duties he shares with the liner captain the obligation to represent his company to its passengers. A passenger's impression of service is very largely an impression of the pilot and the way he goes about his work. He has the responsibility of a professional man and he ought to be in a position to look forward to a long and respected career of respon-

sible service, and to suitable economic protection for his later years at the end of his professional activity. Piloting of transport planes is not merely the employment of a specialized skill, but rather the endless application of judgment and experience to the solution of problems endlessly new. It cannot be classed as "labor" as ordinarily interpreted. If it were ever to fall into that category, or ever to find its compensation limited to the levels within which the wages of labor ordinarily lie, it would be a sad day for air transportation. We do not for a moment believe that anything of that sort will happen, but it would be equally serious if any pilot were to allow himself to relapse into contentment with himself and his work. Any pilot who began to think of himself simply as a man with a job would very soon under the inexorable pressure of progress, find himself a man without one.

Research to the Fore

ABOUT THIS TIME each year the aircraft industry prepares to move in in force on Langley Field and the laboratories of the N A C A. This springtime visit has become an annual habit, and out of the annual attendance of 200 or 300 at the N A C A field day the majority are veterans who have acquired the habit so thoroughly that they never think of missing the trip. In the last two or three years those old-timers have been sensing a change in the atmosphere of the meeting, for an interest in the detail of research equipment, method, and results that was once concentrated among scientists has spread to every group in the aircraft industry. The representatives of the builders of aircraft for the military market attend in steadily growing numbers, and the manufacturers of light commercial craft and the operators of airlines, though they came comparatively late to the roster of the meeting, are finally beginning to play a part.

ALL THIS is quite a compliment to the National Advisory Committee, but it is much more than that,—it is evidence of a new appreciation of the vital importance of the scientific fundamentals of aircraft design. Research has ceased to be the servant of aeronautical development, and has become its guide. One need not go to the very remote past to find that research, like God and the doctor in the ancient jingle, was valued by the man of strictly practical interests principally in time of trouble, when he had run into an unexpected obstacle and needed to have it removed in a hurry. Now he has learned not only to avoid the obstacle by a sufficiently intense preliminary study, but to make certain that he is really getting the best possible result from his product, and not merely a passably good one, by trying out the whole range of possible alternatives under laboratory conditions. On a modern high-speed transport the difference between a wing-fuselage fillet casually faired in to look about right and one determined as the ideal through a long series of studies in the wind tunnel may be 3 m p h in maximum speed. On a 12-passenger twin-engined transport that means a saving of about $2,500 a year in operating cost on a single plane. On an order for twenty such planes, the saving in a single year would be enough to pay the cost of building and equipping a first-class wind tunnel in which to do the work. That fact has made itself felt, and whereas no more than four or five years ago it was rather an extraordinary thing to have any extensive wind-tunnel testing done before building a new ship it has now become the general rule. Not only the wind tunnel, but the seaplane channel as well, has become an accepted and an almost necessary instrument of the designer in his preliminary planning of a new type.

AVIATION has suffered at times from a delusive belief, which one may still encounter here and there, that research and analysis in airplane design are futile frills and that what is needed is to have a good practical man with an extended experience as a pilot and a good eye for line draw a picture of the new airplane and build it accordingly. There was a time when that went so far that the very making of engineering drawings for an experimental machine was considered to fall under the head of "frills," and one pioneer builder used to boast that "he could start in the middle and work outwards and not decide what anything on the plane was going to be like until he came to it." That certainly is one way of doing it, but not the best way. How far it is from being the best becomes apparent when the practical man scornful of theory and of research has done his best and when another designer unhampered by any such scorn, but possessed of wind tunnels and believing their results, takes the same set of specifications and produces a machine to be put into the competition. The airplane built by inspiration and by seasoned judgment is prone to look extremely foolish, under those conditions, as against the ship in which judgment is backed by careful application of science and of laboratory technique.

Already it is true that a majority of America's foremost airplane builders either have wind tunnels of their own or have access to the tunnels of neighboring universities. We predict that within another three or four years the company that fails to own and operate its own tunnel will be quite out of the running, and that an aerodynamic section attached to every engineering staff, with its personnel concerning themselves exclusively with aerodynamic research and with the analysis of aerodynamic problems handed over to them by the designers, will be no questionable extravagance but quite as much of a necessity as the stress analysis group is today. The compass points that way, and the wise management will make its plans accordingly.

NEWS OF THE MONTH

Army surrenders mail

THE problematical air mail situation reached a temporary settlement on May 3 when Postmaster General Farley awarded three-month contracts to the lowest bidders on fifteen of the routes advertised on March 30 and April 6 respectively (for list of bidders and their bids, see AVIATION, May, page 138). Former mail carriers awarded contracts were United Air Lines, TWA, Inc, Eastern Air Lines; General Air Lines (Western Air Express); American Airlines. Newcomers to the mail fold comprised Pacific Seaboard Airlines, Wyoming Air Service, Central Airlines, Long and Harmon. Bids from two heretofore independent operators, Hanford Tri State Air Lines, Braniff Airways, and one independent, Alfred Frank, were held in abeyance pending receipt of further information concerning their qualifications. A few days later, Braniff and Frank received contracts for the Chicago-Fort Worth, and the Salt Lake City-Great Falls, Mont., routes respectively, and on May 15 Hanford Tri-State was awarded the Chicago-Pembina, N D, run. Thrown out were bids from Kohler Aviation Corporation, Northern Air Transport, Inc, and Syra Aviation Corporation for various reasons. Kohler had never held a contract with the Post Office Department but had operated under a subcontract from Northwest Airways for the Detroit-Milwaukee route. Consequently, it would not have been disbarred from rebidding. For reasons still somewhat obscure, Kohler adopted as vice-president R W Robbins (TWA), persona non grata to the administration because he participated in the May, 1930, conference. Northern Air Transport, low bidder on the Fargo, N D-Seattle route, was disqualified because of its inadequate equipment, the illegal form of its bid, and failure to include reports of its financial responsibility. Ten days later the contract for this route was awarded to Northwest Air Lines, a former mail contractor and high bidder on the route. The bid of Syra Aviation Corporation on the route from Boston to Fort Worth was rejected because the Post Office Department wanted to rearrange the route from Fort Worth to the East.

When the contracts were awarded, Mr Farley announced that bids on ten new routes would be sought immediately and would be opened on May 25. Re-advertised at the same time were the route from Detroit to Milwaukee, and the Boston-Fort Worth route, now split into three segments. Two segments were advertised as new routes—the first from Boston to Cleveland by way of Albany and Buffalo, and the second from Cleveland to Nashville via Columbus and Louisville. The third segment became part of an entirely new run from Dallas to Washington by way of Nashville. An alternate route over the same territory, terminating at Newark, was likewise advertised.

The competition for the new contracts was considerably hotter than the bidding had been heretofore. There were, for example, as many as nine bidders for the Cleveland-Nashville run, eight on the route between Daytona and St Petersburg, Fla., and six on the Billings-Cheyenne and New Orleans-Houston routes, respectively. Many of the would be contractors were dark horses, introducing names previously unknown to air transport. Most startling bid came from American Airlines, offering the all-time low of 8 cents per airplane-mile for the Chicago-Fort Worth run. Its closest competitor was Braniff Air Lines, bidding 17½ cents. On the route between Newark and Fort Worth, American Airlines bid 13 cents as against Braniff's 33⅓ cents, and on the alternate route from Washington to Fort Worth, American Airlines bid 39½ cents, Braniff 34½ cents. Lowest bidder on the Cleveland Nashville route was Braniff Air Lines with 14½ cents. On the Daytona St Petersburg run Franklin & Baker had low place with 17 cents. E. T Vance and Wyoming Air Services almost tied for low place on the Billings-Cheyenne run bidding 28.9 cents and 28.5 cents respectively. Robertson Airplane Service (16.7 cents) and Wedell-Williams (17.5 cents) were low for New Orleans-Houston. In contrast to these, there was but one bid for the Boston-Burlington route, that of National Airways, offering 29½ cents. Braniff was again low bidder for service between Boston and Cleveland with 24½ cents, and once more on the Washington-Chicago route at 29 cents. Other low bidders were Varney Speed Lines (24 cents) for the Pueblo-El Paso route, Hanford Tri-State (18.9 cents) between St Paul and Kansas City, Pennsylvania Air Lines (38.9 cents) from Detroit to Milwaukee, Delta Aviation Corp (24.8 cents) for the Charleston-Fort Worth route. Save for American Airlines no former contractor was low bidder on any route. Gratified with these results, Postmaster General Farley estimated the annual outlay under the new system at $7,700,200 ($14,000,000 was appropriated for the present fiscal year). The average pay per mile will be 27.9 cents as compared with the previous rate of 42 cents.

The new air mail map as conceived by the Post Office Department will cover 28,548 miles, an increase of 3,300 miles over the mileage flown before cancellation. Four additional states, 21 additional cities will be served. But because of curtailed schedules the daily trip mileage will amount to only 78,198 miles as against 97,076 miles flown daily under the pre-cancellation system. (See map for comparison of routes

Calendar

Indefinite—Dedication of Pan-American Airways International Marine Airport, Dinner Key, Fla.

June 8—Conference of The North East Region of The National Association of State Aviation Officials New York City

June 9-16 — Coupe Mondiale d'Acrobatie Aerienne (International Aerobatic Competition), Vincennes Paris, France.

June 16-October—Exhibition of Italian Aeronautics, Milan Italy

June 17-22—Summer Meeting Society of Automotive Engineers Lake Saranac, N Y

June 19-24—Pacific Coast Meeting Society of Automotive Engineers, University of California, Berkeley, Cal.

June 30—Royal Air Force Display, Hendon, England.

June 23 July 8—Annual meeting Soaring Society of America, Elmira, New York.

July 13-14—King's Cup Race, Hatfield, London, England

July 22-25—Annual Michigan Air Tour, auspices of State Board of Aeronautics.

July 22-Aug 5—Fifteenth annual Rhone Glider Contest, Wasserkuppe, Germany

September 27-29—Fourth Annual Meeting National Association of State Aviation Officials, Cheyenne, Wyoming

October—MacRobertson International Air Race, London to Australia

November—Viceroy's Challenge Trophy 700 mile race, India.

flown under old and new contracts)

The Army Air Corps wound up its mail operations with great eclat Using new Martin bombers and Curtiss A-12 attack planes, army fliers relayed a mail load across the continent at an average speed of 191 m p h , including stops The mail arrived in Newark fourteen hours eight minutes after leaving San Francisco, which the Army considered a record for the distance of 2,718 miles

Private companies took up where they had left off as the Army removed baggage and equipment from zone headquarters and prepared to return to its regular job First of the former contractors to resume mail carrying was United Air Lines on May 8 over its northern transcontinental and Pacific Coast routes Renewing their mail service as dramatically as they had terminated it on Feb 19 with the 13 hour flight across the continent in the Douglas transport, TWA delivered its first mail load to Newark from Los Angeles in the new record time of eleven hours, 31 minutes Jack Frye, vice-president of TWA, made the flight in a Northrop Gamma mail plane equipped with a 700-hp Wright Cyclone engine.

Meanwhile the Senate and the House appointed conferees to iron out the differences between the McKellar-Black Air Mail and the Mead Bill (passed by the House on May 10) They agreed, on May 22, on a bill placing air mail rates under the supervision of the Interstate Commerce Commission, and providing that temporary contracts already let and those to be awarded may be extended for nine months This will presumably carry the temporary contracts into the period of ICC control, obviating any further necessity for competitive bidding The measure, which was sent back to the House for acceptance, also provides for an aviation policy commission of five members to be appointed by the President and instructed to report to Congress not later than Feb 1, 1935 The conference report on the compromise bill was approved by the House on May 29

Transport on the up-and-up

United Air Lines carried 26,324 passengers during the first three months of 1934, thereby registering a 77 per cent increase over the same period of last year Air express business increased as well, resulting in volume gains during March and April of 75 to 160 per cent over the amount carried during the corresponding months of 1933 To accommodate the increased traffic, United expanded passenger-express schedules, operated in addition to the mail-passenger services designated by the Post Office Department on the New York-San Francisco, Salt Lake City-Seattle, Seattle-San Diego runs On June 1, thirteen round trips a day were scheduled on the Chicago-New York route to maintain the frequency established last summer In addition to the routes on which it operates mail schedules, United will continue operation of passenger-express service between Cleveland and Philadelphia and between Seattle and Spokane

Eastern Air Lines will do 60 per cent of its flying at night under its enlarged schedules, and for the first time passengers as well as mail and express will be included on the overnight trip to Miami from New York. By direct connections with Pan American planes, it is now possible to reach any Cuban port within 24 hours after leaving New York. Formerly only daylight schedules were available to Miami and passengers en route to Latin America spent the night in Florida

ADDITION AND SUBTRACTION

When the Post Office Department drew up the new air mail map for temporary contracts, some routes were dropped others added (The map should also show a broken line between Kansas City and Chicago)

Another run to Miami, carrying mail and express but no passengers will be made during the day There will be one round trip daily to Atlanta, to be flown at night, and seven round trips daily to Washington, both day and night

Extending its services in the East, American Airlines placed tri-motored Stinsons on a new route between Newark and Springfield, Massachusetts with stops at Hartford The run is covered in an hour and a quarter flying time. Elmira, N Y , is a new stop on an additional daily schedule between Newark and Detroit with Ford transports As soon as construction work is completed at the Scranton, Pa , airport regular stops at that city will be included The 90-minute non-stop Boston New York service inaugurated last March with new fifteen passenger Condors was increased to five round trips daily on May 15 Hartford will be served with three daily schedules from New York, and one Boston-Hartford schedule in each direction.

The Boston-Maine-Central Vermont Airways are experimenting with additional passenger service between Boston and Burlington, Vt , including stops at Manchester and Concord, N H , and at White River Junction, Montpelier, and Barre, Vt One of the two daily trips is extended through in each direction to Montreal, Canada

A report from the Department of Commerce indicated a sharp drop in passenger traffic immediately after cancellation and reduction of total mileage by about one third of that flown before Passenger-miles in March were still 6 per cent above those of the corresponding month in 1933 and gaining rapidly

War machines for U. S.

The initial step in the Army Air Corps three-year 1,000 plane program was taken on May 9 by Assistant Secretary of War Woodring when he issued invitations for competitive bids on 80 bombers, bought with PWA funds Minimum specifications for the new bombers require twin-engine ships capable of flying 200 m p h with a full load a service ceiling of 20,000 ft , and a range of about 1 000 miles Later requests were sent out for 90 attack planes Thirty will be paid for with the remainder of PWA's $7,500,000, the other 60 with appropriations for 1935 The planes must have a top speed of 200 m p h , 15,000 ft service ceiling and 1,000-mile range A speed of 250 m p h was indicated as desirable in the specifications for both types

Design for spending

The voluminous report presented to the House by the Rogers sub-committee investigating procurement followed the anticipated course (AVIATION, May, page 156) by assailing the command of the Air Corps and the procurement policies developed over the past few years which had heretofore been generally accepted as fully supported by law and as virtually necessary to the procurement of the best possible aircraft The Rogers committee asserted a finding that Assistant Secretary of War Woodring "fully complied with the spirit and letter of the Air Corps Act of 1926 [which requires competitive bidding for purchases of planes in quantity]." On the other hand the committee found that Major General Foulois, Chief of the Air Corps, and Brig-Gen Henry C Pratt, Chief of the Material Division at Wright Field, by attempting to purchase planes by negotiation, "acted in clear violation of law"

In discussing the original bids for the specifications for the planes to be purchased with PWA's $7,500 000, the report stated "General Foulois testified that in spending this money he desired planes of each type having the largest proven accomplishments and therefore specified types that he had every reason to believe would have a cruising radius of a certain amount, a speed of a certain amount, and other accomplishments He then testified that before the bids were invited a change was made by the Assistant Secretary of War

"In contrast to the testimony of General Foulois, Mr Woodring testified that he had always accepted the recommendations of the Air Corps as to the nature of the craft desired specifications and performance requirements.

"Mr Woodring learned that the Air Corps had definitely decided to spend this money by negotiation and that it had already picked out the companies from whom it intended to purchase the attack, pursuit and bombardment planes The Northrop Corporation the Boeing Airplane Company, the Glenn L Martin Company

"Mr Woodring definitely told General Foulois and General Pratt that he would not permit the spending of $7,500 000 by negotiated purchases, but would insist on the clear intent of the law and have such purchases made by competitive bidding "

Though there had been some talk about interference on the part of the General Staff in the Air Corps program, the committee found from the testimony of General MacArthur, Chief of Staff that the General Staff had specified only the types of airplanes to be purchased, had not intervened in the matter of models nor specifications

In addition to the testimony of the principals involved in the dispute, the report includes the text of the Army Judge Advocate General's memorandum on aircraft purchases, extracts from the Navy Judge Advocate's opinion, and a review by the Comptroller General.

In a public statement General Foulois denied the implications of the press that the Air Corps officers drew up the circulars for new airplanes in a manner known to them to be illegal. In his defense he stated that he had followed exactly the same procedure that he and his predecessors had followed over a number of years and that had heretofore been approved by higher authority, that when Mr. Woodring decided upon a change in the method of procurement the Air Corps personnel concerned were completely loyal and co-operative, and finally that prior to the issuance of proposals for bids, they were first approved by a representative of the Judge Advocate General, who was called in to assist in preparing them by the office of the Assistant Secretary of War

The subcommittee promised shortly to make a further report with specific recommendations covering other matters dealing with national defense including alleged profiteering in aircraft sales to the War Department

Gains for Pan-American

Pan American Airways System Inc , realized improved earnings and a substantially improved financial condition for 1933 over 1932 according to its annual report to stockholders Net income for 1933 was $898,488 after depreciation, amortization, provision for all taxes and other charges This was

150 M.P.H. PLUS

A year and a half of engineering effort culminates in successful test flight of Stinson's new Model A airliner Technical features were described in AVIATION for February

equivalent to $1.42 a share on 631,640 shares of capital stock outstanding, and compared with $1.36 per share of 512,581 capital shares in 1932. (The additional shares represented the exercising of option warrants which matured in the year.) During the year the net consolidated earned surplus of the company rose from $188,328 to $721,779, after deduction of $284,983 of reserves for self-insured risks. Current assets on Dec. 31 were $2,117,976 and current liabilities were $669,888 leaving net working capital of $1,448,088. This compared with working capital of $1,366,000 a year earlier when current assets were $1,763,475 and current liabilities $396,682. In the auditors' statement it is reported that cash to the amount of $72,983 held by the corporation in December, 1933, in connection with the management stock purchase plan of the company is not included in the consolidated statement.

President Juan T. Trippe stated in his message to stockholders that for the first time in four years, America's foreign commerce was on the up-grade as evidenced by the record marks established by Pan American. Passenger traffic was up 40 per cent, express volume up 80 per cent over 1932.

Pilots' wage scale

A solution was offered for the complicated pilots wage tangle (AVIATION, December, page 382) deliberated since last September by the National Labor Board, in its decision made public on May 10. Attempting to provide for a basis of payment which would distribute equally among operators and pilots the benefits and burdens accruing from present and future technological improvements in transport equipment, the Board recommended a combination of the hourly basis of payment supported by operators and the mileage basis of payment demanded by the Air Line Pilots Association. Specifically, the Board recommended that pilots be paid the base rate ($1,600 per year with an increase of $200 for each year of service) plus an hourly rate of $4 for speeds under 125 m.p.h. An additional 20 cents per mile would be paid for each 15 m.p.h. sperd increase up to $5 (200 m.p.h. and over). For night flying the rate would be raised to $6 for speed under 125 m.p.h. with an additional 30 cents for each 15 m.p.h. increase. (The rates placed in effect by operators of the major air lines in October, 1933, provide this same rate of payment for day flying, and add $2 per hour flat for night flying.

In addition to the hourly payments, the Board further recommended that premiums be paid proportional to the number of miles flown by a pilot monthly. He would receive 2 cents per mile for all miles per hour flown at more than 100 m.p.h. at monthly mileages of under 10,000 miles. If a pilot flew over 10,000 miles and less than 12,000 miles during a month he would receive 1½ cents per mile. For flying more than 12,000 miles during the month he would be paid at the rate of 1 cent per mile, assuming always that his cruising speed exceeded 100 m.p.h.

The Board set 85 hours of flying per month as the maximum that could be flown without impairing a pilot's efficiency, but offered no maximum for monthly mileage, explaining that "experience has not crystallized sufficiently to make an estimate on that point."

The last two provisions of the projected plan stated that the differentials existing on Oct. 1 for co-pilots and for flying over hazardous terrain would be maintained, and that the new basis of payment would be in force for one year.

Assuming that a pilot flew 12,000 miles in one month, the Board's scheme of payment, which allows additional pay for mileage flown at speeds beyond 100 m.p.h., would net him a monthly income ranging from $776 at 100 m.p.h. to $620 at 200 m.p.h. According to the companies' scale also the pilot's income decreases, but at a greater rate. For example a pilot flying 12,000 miles during a month would earn $776 if his plane had a cruising speed of 100 m.p.h. and only $536 if the cruising speed were 200 m.p.h. On the basis of the Air Line Pilots Association's demands the monthly pay would remain constant for the same mileage regardless of speed.

D. of C. seeks easier-flying ships

The Department of Commerce has issued invitations to bid on the manufacture of 25 airplanes to meet specifications of quite unprecedented type. To be bought for the general use of the Department, they must have a minimum speed of 35 m.p.h., a maximum of 110 m.p.h., take off over a 35-ft. obstacle in 800 ft., seat two passengers side by side and possess some rather exceptional landing qualities, including an ability to make safe landings either by stalling at a considerable altitude and settling into the ground without flattening the path at all or by coming in at high speed and immediately applying brakes without bad result. The engine must not be over 100 hp. Fuselages must be all metal. Bids will be opened July 25. *(Fuller details in* AVIATION *next month.)*

New Federal airways

Powerful beacons are illuminating the 110-mile airway between Louisville and Indianapolis, and the route between Omaha, Neb., and Davenport, Iowa, thanks to the good work of the Aeronautics Branch and PWA funds (AVIATION, November, page 354). Rex Martin, Assistant Director of Aeronautics also called for bids for construction of a new lighted airway betwen Galveston and Waco, Tex. By the relocation of lights and intermediate landing fields a straight-line airway is being established between Omaha and Chicago. When completed, the airway will go directly east from Omaha connecting with the Kansas City-Chicago route, thereby making the lights conform to the radio range beacon course and providing a shorter route between Omaha, Des Moines and Chicago. An outlet to the southern transcontinental airway and another outlet to the north will be afforded Galveston and Houston with the establishment of the lighted airway to Waco. It will be 200 miles in length with two lighted intermediate fields in addition to rotating beacon lights at 15-mile intervals.

Other important activities of the Air Navigation Division of the Aeronautics Branch include the establishment of a maintenance control system which will place the operation of the Federal Airways on a strictly business basis and afford the Commerce Department a reliable check on the cost and efficiency of operations and equipment.

American planes abroad

The Bellanca Aircraft Corporation of New Castle, Delaware is working on a $300,000 export order. The planes under construction are a military version of the Bellanca Airbus, 12-passenger transport.

A Fairchild 22 (open cockpit monoplane powered with 145 hp. Warner) was ordered by the Colombian government for training military fliers.

Nineteen orders for Electras (amounting to more than $785,000) have been received to date by Lockheed Aircraft Corporation. Six of these were sent in by Anthony H. G. Fokker, international aircraft distributor. Fokker originally purchased one Electra for demonstration purposes and increased the order when performance test showed that the 221 m.p.h. multi-engine transport would substantially cut the time schedules on European airlines. As a result of new contracts the Lockheed company is expanding plant facilities and increasing its staff of employees.

The Northrop Delta now in service on the Swedish airline A. B. Aerotransport recently flew from Stockholm to Paris in four hours, 40 minutes, a record for the 1,000-mile trip.

Latest European company to acquire American equipment is Swissair, purchaser of two Douglas transports.

Sikorsky climbs

The Sikorsky S-42 carried off two international altitude records on May 17 by climbing to 21,800 ft. with a load of more than 11,000 lb. The flight bettered by 5,800 ft. the previons record established by Pilot Sergievsky in the Sikorsky with a 16,500 lb. payload on April 26. The former international record for the category, held by Germany since 1929, was only 6,561 ft.

Flying Services and Flying Schools

■ Four scholarships for courses at the Boeing School of Aeronautics were announced by the award committee of the fifth annual W. E. Boeing Scholarship Contest. First prize (representing a complete Master Pilot Course—tuition value $5,200) went to D. W. Finlay, Oregon State College. The other awards were won by R. H. Schwarz, Oregon State College, F. S. Doyle, Massachusetts Institute of Technology, M. W. Heddon, Bethany College, West Virginia. They will have their choice of the Master Pilot Ground Course, or an intensive Master Mechanic Course. Second award winner receives twenty hours of flying in addition. The committee making the decisions, which are based on essays submitted by undergraduates of colleges and universities throughout the United States and Canada, was composed of Doctor Baldwin M. Woods, head of the Mechanical Engineering Department, University of California; William B. Stout, president of Stout Engineering Laboratories, and Charles N. Monteith, vice-president and chief engineer of the Boeing Airplane Company.

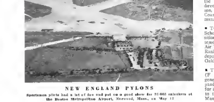
■ In an effort to stimulate interest in the county's need for a good air terminal the Westchester Air Pilots' Association put on a spectacular air show on May 20 at Armonk, N. Y. The program included examples of military aerobatics and formation flying by the National Guard stationed at Miller Field, as well as stunting by the ubiquitous Al Williams. William Rausch, Jr., of White Plains, president of the Association flying a Gee Bee sportster, and Edwin Jones, manager of the airport, staged a "dog fight."

■ Most modern of college endowments is the gift of an airport to Kenyon College at Gambier, Ohio. Kenyon's good angel was Alumnus Wilbur L. Cummings of New York, who also provided a hangar and two training planes to be used in an aviation course offered by the college. At the formal dedication of Gambier Field on April 21, Governor George White of Ohio, Director of Aeronautics Vidal, and David S. Ingalls, of the N.A.A. were among the speakers.

■ Guaranteeing overnight delivery of airplane parts throughout the southeastern states the Montgomery School of Aeronautics, Montgomery Airport, Alabama has opened a new supply shop stocked with all materials used in plane overhaul. The Montgomery school is Fairchild's representative in the southeast.

■ New Englanders, participants and spectators were highly pleased with the amateur pilots' meet at the Boston Metropolitan Airport at Norwood, Mass., on May 13. W. Sherburne Eaton, vice-president of the airport, was chairman of the race committee. Honors in the sport field went to John S. Putnam of Boston, flying a Bull Pup monoplane, while Capt. Al Williams in his flaming Gulfhawk shared applause with Mr. and Mrs. Theodore W. Kenyon of Waban for stunting. Beekman Fairbanks was awarded second place for his flying in a Fairchild monoplane. E. W. Wiggins, head of the E. W. Wiggins Airways, placed third. At least three more air meets are being planned for New England airports in the near future. The college flying clubs in the East are discussing the possibility of competing at Norwood, Hartford's Interstate Airways plans a meet for June 24 at Brainard Field, Victor Kahill, of the Forest City Flying Club of Portland, is organizing a committee to stage a meet in Scarboro, Me.

■ W. B. Kinner, president of the Security National Aircraft Corporation of Downey, Cal., announces two additional distributorships for the Security Airster, the new folding-wing 100 hp. sport plane. James Lund, veteran aircraft dealer in the United States and Mexico, and Art Whitaker, general manager of Northwest Aircraft, Inc., Portland, Ore., are to serve the Northwest territory.



NEW ENGLAND PYLONS

Sportsmen pilots had a lot of fun and put on a good show for 25,000 onlookers at the Boston Metropolitan Airport, Norwood, Mass., on May 13

■ The Ryan School of Aeronautics, San Diego, Cal., reporting for the first four months of 1934 one of the largest enrollments in its history, recently graduated fourteen students. Torsten V. Scheutz young Swedish flier, is enrolled for the transport course, and is giving special attention to blind and night flying and aerobatics. Immediately after receiving his license Scheutz plans to return to Sweden for military service.

■ More than 150 students have registered in the aviation ground school for factory and office employees of the Bendix Aviation Corporation at South Bend, Ind. The school is conducted under the direction of H. S. Cole, also director of the Bendix Service School. Local aviators and aeronautical experts contribute their services as lecturers, and the text books used are the same as those at the School of Military Aeronautics at Wright Field.

■ Championship races under the direction of the newly-formed Northwest Civic Air Meet Association will be held at Portland, Oregon, the latter part of June. A two-day meet with a budget of $50,000 is planned, offering sufficient prize money to be national in scope and to meet the new championship requirements of the N.A.A. Contest Committee. Several prominent Oregonians are officers of the association, including George L. Baker, former Mayor of Portland, president; Dean Vincent, president of the Portland Trust & Savings Bank, treasurer; H. K. Coffey, Governor of the N.A.A. for Oregon, secretary; C. C. Cole, vice-president of the First National Bank of Portland, director of finance, and Larry Therkelson, long-time member for the West Coast of the N.A.A. contest committee, managing director.

■ Two more graduates of the Boeing School of Aeronautics found airline positions last month. H. C. Holland entered the traffic department of United Air Lines at San Francisco and Donald Rankin was employed in the instruments department of United's station at Oakland.

■ The Muncie Aviation Corporation (F. E. Ball, president, Clyde Shockley, general manager) has been forced by expanding business and increasing demand for storage facilities to add an extension to the hangar accommodations on the Muncie, Ind., airport.

Aviation People

Medal-winner.

• The first industrialist to be so honored, **William Edward Boeing**, chairman of the board of Boeing Airplane Company and of United Aircraft & Transport Corporation, has received the Guggenheim Medal, annually awarded, for "successful pioneering and achievement in aircraft manufacture and air transportation" The Daniel Guggenheim award, established in 1928 is sponsored jointly by the American Society of Mechanical Engineers and the Society of Automotive Engineers, each of which appoints four members of the Board of Award The other seven members comprise representatives from Canada, England, France, Germany, Holland, Italy, and Japan Medals have been awarded previously to research workers such as Orville Wright, Dr Ludwig Prandtl, of Germany, Frederick William Lanchester, of England, Juan de la Cierva of Spain, and Dr J C Hunsaker, of the Massachusetts Institute of Technology

• **Hall L Hibbard**, designer of the Electra, was recently elected vice president and chief engineer of Lockheed

Engineer and executive.

Aircraft Corporation In 1931 after his graduation from the Massachusetts Institute of Technology, Mr Hibbard was associated with Lloyd Stearman and Walter Varney When the Lockheed Company changed hands with Mr Stearman as president Mr Hibbard was employed on the engineering staff The success of the Electra gained him the recent promotions

• At Floyd Bennett Field, New York's municipal airport in southernmost Brooklyn, **J Nelson Kelly**, field manager since the opening has resigned Incident to economies instituted by the LaGuardia administration, **F. William Zelcer**, New York business man and well-known amateur pilot (holder of the Amateur Air Pilots Association's championship for proficiency in 1933) becomes dollar-a-year consulting director of the field Acting as active director is **Samuel Levy**, formerly assistant to Mr Kelly

• **Earl R. Southee**, new general manager for the Soaring Society of America, is already at the helm of the summer gliding camp in Elmira, N Y Mr Southee has been connected with many flying services including the Curtiss-Wright school on Long Island, N Y, and for the past three years has been manager of S S A meets.

• **J R. Cunningham** has been named to take charge of communications and technical development for United Air Lines, in the department formerly directed by the late Thorp Hiscock (**Aviation**, April, page 120)

• The Stinson Aircraft Corporation of Wayne Mich, announced the appointment of **B. D DeWeese** as president following the resignation of L B Manning who becomes head of American Airlines. DeWeese has been vice president and general manager of Stinson since 1930, and before that was connected with the administrative end of automobile manufacture

• Newly assigned commanding officers for the naval aircraft carriers include **Capt. Arthur B Cook**, now assistant chief of the Bureau of Aeronautics, U S S Lexington **Capt. Kenneth Whiting**, pilot of twenty years experience, U S S Saratoga, **Capt. Arthur Bristol**, formerly naval attache in London U S S Ranger **Capt Albert C. Read** commander of the NC squadron that flew the Atlantic in 1919, and more recently commander of the Naval Air Station at Hampton Roads U S S Wright

• New procurement officer for the Bureau of Aeronautics, Navy Department in Washington is **Comdr William Nelson**, who has been supervising the inspection of naval aviation material in the New York district, and a special lecturer on seaplane design at New York University

• In accordance with the established change of duty policy of the Navy Department about one-third of the officers of the U S S Macon are being replaced so that other qualified lighter-than-air officers may have actual rigid airship experience Effective in June after the arrival of the fleet in New York, the new assignments include the transfer of **Commdr Alger H Drexel**, from his present post as commanding officer of the Macon to the command of the Naval Air Station at Sunnyvale, Cal **Lt. Commdr Herbert V. Wiley**, Akron survivor, will replace him as commanding officer of the Macon **Lt. Commdr C E Rosendahl** will be placed in command of the Lakehurst, N J, Naval Air Station where he will have charge also of the lighter-than-air training of the Navy The present first officer at Lakehurst, **Lt Commdr J L Kenworthy** has been ordered to duty on the Macon

• **Godfrey L Cabot** of Boston pioneer private flier and vice-president of the Fédération Aeronautique Internationale, sailed for Paris to attend a meeting of the directing committee of the Féderation on May 26. Mr Cabot is also a director, and former president, of the National Aeronautic Association

• Noted as a trophy winner, **John Livingston** is now chief test pilot for Waco Aircraft Formerly a Waco distributor Livingston in his new capacity will conduct the engineering test flying and supervise the testing of new Wacos as they come off the production line Livingston has been conspicuous in the racing events in this country over

Cup-collector and test pilot

a period of years Flying a Waco he won the National Air Tour in 1929, and placed second the following year At the National Air Races in 1931 in Cleveland he carried off thirteen prizes, piloting a Monocoupe

• From the Aeronautics Branch of the Department of Commerce to the Monocoupe Corporation in St Louis goes **Luther Harris**, lately special assistant to Director Vidal, before that engineer for American Airways, and still earlier superintendent of maintenance for Ludington Lines Mr Harris now becomes general manager of Monocoupe.

• President of Eastern Air Transport since 1930 **Capt Thomas B. Doe** resigned on May 1 to become vice-president of Sperry Corporation. Under his

leadership the line has expanded materially and has encouraged the development of many safety and comfort devices including the automatic pilot and soundproof cabins In appreciation E. A T presented Captain Doe with a bronze plaque bearing his portrait.

• To Fleetwings, Inc. manufacturers of stainless-steel structures at Roosevelt Field, goes as sales manager **G Sumner Ireland** A pioneer in aircraft distribution and a manufacturer on his own account Mr Ireland's past merchandising and executive connections have included Curtiss Flying Service, Ireland Aircraft, American Aeronautical Corporation and others

• The former connection of **K J Bossart** with General Aviation is resumed with his appointment to the stress analysis department following a visit to Europe

SIDE SLIPS

By Robert R. Osborn

Side Slip's Special Correspondent Visits the Fleet

(Apologies to the Late Ring Lardner)

Port au Prince, Haiti

DEAR ED I expect you are surprised I am down here with the U S Fleet on account I didn't think to stop in an tell you I was going to go on this trip You see they has been so much investigating by Congress and Special Committees lately versus the Air Mail an the Army an the Navy that I thought I better make an investigation personal, as my vast no of admires an readers of AVIATION would want to know what the score is. You may be suspicious I decide to investigate the Navy on acc't they are making a nice cruise in the Caribbean but such is not so It is only my great devotion to duty for which I am so justly famous which made me make the personnel sacrifices to come down here an I am sure you will approve my expense acc't when you recovered from your surprise that I am here.

A course my report will not be complete until I has took care of the Presidential Review but I has already reached the conclusions our Navy is in 1st class shape in spite what some Congressmen seems to think. The people of the U S can take my personnel assurances this is the best kind of Navy there is an all Congress needs to do to stop worrying is appropriate enough money to keep the no of ships an men equal to other nations The quality is okay,—all Congress needs talk about is quantity

In facts if they was a real war on and I was on a enemy battleship I would be writing this from some lonely island surrounded by dusky beauties an tall palms, which would be okay even without the palms, an account of they has been theoretically sunk twice As some of my admirers an readers may not understand words versus more than one syllable, I will explain that theoretically means they are only fooling an don't actually sink the ships Sort of like gambling but not for keeps Speaking about gambling reminds me about a item on my expense acc't which may need explaining In the cool of the evenings I has been teaching some of the boys the principals of Poker an as they has learned very quickly and in a gratifying manner I has lost a small amount each night These losses are not theoretical as I found they always play for keeps, an I has entered these am'ts as "General Expense" which will explain why that item is so large.

They has been one feature I observed which has convinced me maybe Navy pilots has become a little softer than they used to be In flying from these here carriers they is a fellow with a flag tells the pilots when to take off an another fellow with two flags tells them how an when to land. Now, most of these pilots were flying back in Jenny and D H days an in those days these same lads could have landed in a pasture the size of this deck, side slipping over a fence an some trees an maybe missing a couple of cows too, an with assistance from no traffic cop However, I'll admit the cow pasture wouldn't be rising up an down twenty feet or so, during the landing so maybe these Navy pilots is entitled to a couple of lads to help them fly after all

Speaking of cow pastures reminds me of a strange happening which I will now relate They was some horse races held while we was in port here an on account of my well known knowledge of horse flesh, I desided you'd appreciate it if I reduced my expences by a few well placed bets Well the heat must affect horses different here than in New Orleans an I had some difficulty with my selections In one race my horse wouldn't even start until some body called out a street address in Port au Prince an in another race the last I seen of my horse he was standing at the quarter mile post wondering which side of it he should go A course these small am'ts contributed in the form of bets goes for the improvement of conditions among the people of Haiti associated with racing, an improves international relations I has entered these small am'ts under "General Expenses"

One thing I has to hand these Navy lads is they certainly knows their way around in the air or on the sea When they fly a couple hundred miles away from the ship they's nothing gets them back but a few pencil marks on a chart an a weather eye on the compass An if one of these pilots gets his decimal point wrong in the figuring it's a serious matter an not just like having a bridge fall in a river, as it would be for an engineer There's no recognizing the freight yards at Birmingham or a lot of black smoke you know is Pittsburgh, to help you either,—you get back by your own arithmetic An the way a whole formation of these battleships can douse all lights and steam full tilt through a lot of islands without nicking no islands or each other is marvelous too

One thing sure gave me a thrill this trip was to visit the anchor windlass room when the anchor is let go They just let it go,—an you never saw such fireworks The only way I can describe it would be like you put all of the people who'd like to take a sock at Senator Huey Long into one room an dropped Huey in the middle of them.

We had another thrill too but didn't know about it until afterward We all went swimming at a beautiful beach one day an had a swell time That night the Chief of Police come aboard an told us about the playful habits of a local fish called the Barracuda, with details regards fatalities at that beach We was all wondering how to get out of swimming the next day without being sissies when fortunately swimming was forbid that day

Well Ed, I will close for now but I must say a few words regards the Navy hospitality I has heard a lot about and has experienced a lot of the famed Southern hospitality, but I'll bet on Navy hospitality against any kind They has treated me swell A course I might have expected unusual attention if I told them who I was but as I has travelled incognito all the time, it just goes to show

Y'rs v'y Tr'ly
THE INTREPID AVIATOR

FLYING EQUIPMENT

Wacos for 1934

OUT at Howard Ailor's Roosevelt Field headquarters last week, we had an opportunity to inspect the new Wacos. The Model C, four-place, appears this year in two standard forms, differing chiefly in power plant installation. The UKC carries the Continental R-670 engine rated 210 hp. at 2,000 r.p.m. The YKC is fitted with the new Jacobs L-4 engine delivering 225 hp at 2000 r.p.m. They exhibit minor variations as follows:

	Model UKC	Model YKC
Length overall (ft.-in.)	25'-2⅛"	25'-4⅛"
Height overall (ft.-in.)	8' 6"	8' 6"
Span overall (ft. in.)	33' 2⅞"	33' 2⅞"
Wing area (sq. ft.)	240	240
Weight empty (lb.)	1755	1808
Useful load (lb.)	1245	1192
Payload (lb.)	745	692
Gross weight (lb.)	3000	3000
Wing loading (lb. per sq. ft.)	12.5	12.5
Power loading (lb. per hp.)	14.3	13.3
Fuel consumption cruising (gal. per hr.)	13.0	14.0
High speed (m. p.h.)	145.5	148.5
Cruising speed (m. p.h.)	128	130
Landing speed (m. p.h.)	52	52
Climb at sea level (ft. per min.)	750	800
Service ceiling (ft.)	13,000	15,000

Model C-1 Waco accommodates the Wright R-760-E Whirlwind of 250 hp. It has a wing area of 264.3 sq.ft., weighs 3,200 lb. gross, shows a top speed of 152 m.p.h.

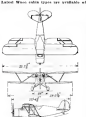
Construction details follow standard Waco practice. Fuselages and tail units are of welded steel tubing fabric covered. Wings have wooden spars, wooden ribs and are fabric covered. Ailerons are of corrugated dural sheets. A small tab in the trailing edge of the rudder (adjustable on the ground only) does away with the necessity of providing any fin adjustment for torque correction. Landing gear is of the single strut, wire braced Waco type well faired at the wheels and into the fuselage. Autofan brakes and shock absorbers are fitted. A wooden propeller is standard for all models except the Wright-powered C-1. Heywood air injection starter is provided for the Continental-powered ship. The Jacobs installation includes an electric starter, engine driven generator, and battery ignition.

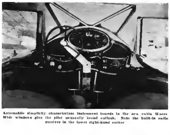
The Waco D is a new ship in the covered cockpit class designed to yield high performances. It will take engines ranging from the Wright 250 to 420-hp Whirlwinds, and the Pratt and Whitney Wasp Juniors. Its speeds approach 200 m.p.h. A full description of this ship will appear in a later issue.

In the open cockpit field, the UMF and the YMF are offered. Each can be arranged either as a single-seater, or for three people. The UMF carries the Continental R-670 at 210 hp., and, except for the fact that its lines have been considerably cleaned up, it follows the older Model F pattern. Full N.A.C.A. cowling, wing root fairings, and wheel pants are obvious additions. Its structural features are similar to those outlined above for the cabin models. General specifications are: length overall, 23 ft. 1¾ in.; height overall, 8 ft. 5⅜ in.; span, 30 ft.; total wing area, 233.5 sq.ft.; weight empty, 1,485 lb.; useful load, 1,015 lb.; payload, 515 lb.; gross weight, 2,500 lb.; wing loading, 10.7 lb. per sq.ft.; power loading, 11.9 lb. per hp. The engine consumes 13 gal. per hour of fuel at cruising speed and the tankage amounts to 50 gal. The ship has a top speed of 143 m.p.h., cruises at 128 m.p.h., lands at 47 m.p.h. Climb at sea level is 1,110 ft. a minute.

All Waco models, open or closed, may be had as twin-float seaplanes.

Latest Waco cabin types are available with Continental, Jacobs or Wright engines





Automobile simplicity characterizes instrument boards in the new cabin Wacos. Wide windows give the pilot unusually broad outlook. Note the built-in radio receiver in the lower right-hand corner

Kinner Four-Place Cabin

ALTHOUGH Kinner is not a newcomer in the cabin field (readers will recall that the 160 hp Playboy was described in the December, 1933, issue of AVIATION) seating capacity has heretofore been limited to two. With the design and construction of a new engine, however, the 300 hp seven cylinder model (see AVIATION, February, 1934), it has been possible to enter the four-place class with the C-7.

Although the layout of C-7 and Playboy are essentially similar, the new ship is considerably larger in overall dimensions. Where the two-place machine had a span of 29 ft. and length overall of 24 ft. 2 in., the new model measures 39 ft. 8⅜ in. from tip to tip, and 28 ft. 7¾ in. from nose to tail. With the 160 hp R-5 engine and a gross weight of 2,170 lb. (of which 800 was useful), the Playboy showed a top speed of 135 m.p.h. The C-7, on the other hand, with 300 hp, a gross weight of 4,000 lb. and a useful load of 1,470 lb., has a top of 168 m.p.h., cruises at 145. The C-7 is also fitted with trailing edge landing flaps which reduce the landing speed to about 48 m.p.h. It has a rate of climb at sea level of about 1,000 ft. per min., and can attain an absolute ceiling of 19,000 ft.

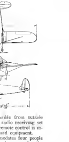
Few radical changes have been made in construction from previous Kinner machines. Fuselage and tail surfaces are of welded steel tube. Wing beams and ribs are of wood and the whole machine is fabric covered. Each of the main landing wheels is independently hung from the wing stub, and completely faired. The gear is wire braced laterally with the bracing wires forming a part of the wing truss system. The engine is completely housed in an N.A.C.A. type cowling, streamlined and provided with individual rocker box bonnets. Controls are ball bearing throughout. The stabilizer is fixed, and tabs are provided in the trailing edge of the elevators for longitudinal trim. The plane structure is bonded for radio, and the engine is provided with complete radio shielding.

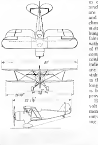
Electric generator, starter and 12-volt storage battery are standard equipment. The latter can be removed from outside the ship for charging and servicing. Luggage compartments in the fuselage are also accessible from outside doors. A Westport radio receiving set with direct reading remote control is included in the standard equipment.

The cabin accommodates four people comfortably. Safety glass is used in the windows all around. The forward sloping windshield of the transport type is usually not found in ships of this class. Dual controls of the throw-over type make it possible to fly from either front seat.

Specifications not mentioned above include wing area (including under side of fuselage between wings), 225 sq.ft.; weight empty, 2,500 lb.; gasoline capacity, 85 gal.; fuel consumption cruising at 140 m.p.h., 18 gal per hour.

Kinner enters a new plane in the four place cabin class





The Continental-powered Waco UMF. The YMF has a Jacobs L-4 engine.

International Aero Show

EUROPEAN manufacturers took advantage of the Aero Club of Switzerland show at Geneva to exhibit some of their latest wares. The exposition was devoted almost exclusively to airplanes of the sport and touring class; no transport types appeared (except for one of the Swissair's American-built Lockheed Orions) and no military ships were in evidence.

The British de Havilland Company showed its well-known Tiger Moth and

Leopard Moth, as well as the latest Moth Major fitted with the Gypsy Major engine Other British exhibits included the Miles Hawk with Cirrus engine (two-place open cockpit, low-wing monoplane) and Blackburn with the latest B2 model, open cockpit, side-by-side biplane with the Hermes IV engine This machine, incidentally has a metal-covered fuselage

For the French, Potez exhibited the new 58 a high wing cabin monoplane in about the same class as our new Fairchild 24 (see AVIATION for May) This machine is notable for its use of fixed Handley Page wing slots It is powered with a six-cylinder radial Potez 6B with a maximum of 140 hp. Farman showed a machine in the same general class—a three-place cabin monoplane, with a full cantilever wing. Its power plant is a five-cylinder radial Lorraine of 110 hp Unlike the Potez and the Fairchild, the three seats are in tandem A top speed of 120 m p h is reported The C-282 Phalene by Caudron-Renault is a cabin machine of a somewhat larger size, accommodating four people A four cylinder in line inverted Renault Bengali engine with a maximum of 145 hp is fitted Caudron also exhibited the racing machine which competed for the Coupe Deutsch.

The Italian Caproni 125 has been described by one of our British contemporaries as "motherly looking," presumably on account of a deep and well-rounded fuselage It is a two-place tandem biplane powered with a Colombo 150 hp six-cylinder engine Savoia, another Italian exhibitor, showed an interesting amphibian monoplane with a pusher power plant mounted in a nacelle over the center section

German representation included the all-steel Adler, two-seater tandem biplane powered with an 80-hp four-cylinder inverted Hirth engine, a machine well known in German schools under its former name the Gerner Klemm was represented by a low-wing cabin monoplane for four people powered with a Siemens engine. Bayerische Flugzeug Werke made quite an impression with the latest Messerschmitt M 35 a two-place open cockpit low-wing monoplane

The latest heavy bombardment machine for the French Air Forces the Potez 41

characterized by an unusually nice external finish This machine was fitted with an N A C A cowling

Only two Swiss manufacturers were represented Alfred Comte with his Model A.C.12, full cantilever wood and metal monoplane with some general resemblance to the well known British Desotter, powered with a seven cylinder Siddeley Genet Major The Swiss Aircraft factory at Grenchen, showed a power-driven Model W.F.11 a two seater tandem open cockpit biplane with a British Pobjoy engine

For the French Air Forces

THE latest in French heavy bombers is the Potez 41, illustrated at the top of the page An all-metal full cantilevered monoplane, it shows an unusual power plant arrangement for a landplane,—twin tandem engine nacelles, mounted above the wings, on each side of the fuselage

Two-Place Pursuit

IN our January issue we published a photograph of a two-place low-wing pursuit monoplane for the Army Air Corps by Consolidated of Buffalo Release has just been obtained on a photograph of the latest version of this machine, substantially similar to the prior model, but carrying an exhaust driven centrifugal super-charger Further external cleaning up has been obtained through the use of single strut landing gear The photograph shows clearly how the wheels fold up into the under part of the center section The engine is a Curtiss Wright geared Conqueror

A formidable weapon—Consolidated's new two place fighter—the P-30.

In the British Manner

TO MEET the requirements of the Australian Government for equipment to fly that leg of the British-Australia air route between Singapore and Cootamundra (New South Wales) by way of Port Darwin the British de Haviland Aircraft Company designed, built, tested and obtained Air Ministry approval on the D H 86 Express Air Liner" in the extraordinarily short time of four months A glance at a map of the route gives a clue to the extreme to which the purchaser went in specifying power plant subdivision The total of approximately 800 hp is obtained from four of the new D H Gipsy-Six, air-cooled, inverted, in-line engines The performance tests have indicated that with one engine out of commission a speed of 92 m p h may be maintained up to 15,000 ft, and with only two engines in operation (and those both on the same side), controlled flight may be maintained up to 3 600 ft

The use of the four engines of this type has made possible a rather extraordinary reduction in the frontal area of the whole power plant. The housing for the two in-board engines has been combined with the fairings of the under-carriage and the outboard engines located at the intermediate strut points in the wing appear to contribute relatively little additional drag to the cellule These factors, combined with the generally good form of the entire ship are unquestionably responsible for the rather exceptional performance as far as speed is concerned The top with full load is reported as better than 170 m.p h

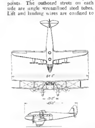
Another unusual external characteristic is in the wing arrangement Most of the known means of increasing aerodynamic efficiency have been employed—tapered plan form, high gap ratio and unusually high aspect ratio The latter is particularly notable. Where most biplanes show aspect ratios in the range of six to eight, the D H 86 has an effective ratio of about 12 The stagger is not very great

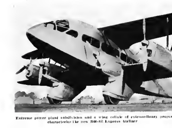
From an American point of view, the structure of the DH 86 is unique The fuselage is a rectangular plywood box, reinforced by four spruce longerons at the corners and a number of intermediate longitudinal stringers, all of which are on the outside of the box. The ply wood panels, therefore, form the cabin lining directly The outside of the structure is covered with fabric. Insulating material is packed into the spaces between the inner panels and the outside fabric covering As for the wings, composite metal and wooden construction is employed, with fabric covering The section of the lower wing which carries the engines on the under-carriage is built with steel tube spars and wooden ribs' The balance of the cellule consists of wooden spars and wooden ribs, the spars separated by tubular steel compression struts with tie-rod bracing Interplane struts are of the N-type at the intermediate panel points The outboard struts on each side are single streamlined steel tubes. Lift and landing wires are confined to the front bay only, eliminating distortion if any wire should fail,—also simplifying rigging and reducing parasite drag

The tail surfaces are of typical de Havilland form and construction The rudder is assisted by an automatic trailing edge flap, somewhat similar in principle to that applied to the old Boeing 80 (See AVIATION, September, 1932) The device is also interconnected with the fin adjusting gear which is operated from the cockpit to take care of any unbalanced power plant condition. All control surfaces are wooden-framed and covered with plywood to afford maximum torsional stiffness

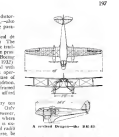
The ship is designed to carry ten passengers and a crew of two Only one pilot's post is provided, however, far up in the nose of the ship, where vision in all essential directions is excellent Place for a navigator and radio operator (who may also of course, be a relief pilot), is provided to the rear and slightly to the right There is plenty of space available so that the crew may change places conveniently The pilot's controls are of the usual wheel and rudder bar variety Longitudinal trim is obtained by means of adjusting the whole stabilizer rather than by means of tabs as is common in current American practice Control for both the fin offset and the stabilizer is by large handwheels located beside the pilot's seat Wheel brakes are operatable from a combination of hand lever and rudder pedal action.

The cockpit is separated from the main cabin by a bulkhead and door The passenger space is 16 ft 3 in long, 5 ft 0 in wide and 6 ft 3 in. high A variety of seating accommodations may be installed to suit the needs of purchasers Broad windows running the full length of the cabin give passengers an unusually good view A communicating door leads to a washroom of 42 cu.ft capacity Further aft is a baggage compartment of equal size which is entered through an exterior door Cabin ventilation comes from individually controlled registers. Heating can be provided when necessary by passing incoming air over stoves connected to the exhaust.





Extreme power plant subdivision and a wing cellule of extraordinary proportions characterize the new DH-86 Express Airliner



A revised Dragon—the DH 89

The general specifications show the span, 64 ft. 6 in , length overall, 43 ft 11 in , height overall, 12 ft. 6 in , total wing area, 641 sq ft ; weight empty 5,520 lb , total disposable load 3,680 lb (of which 1,939 lb is payload) , gross weight 9,200 lb ; wing loading 14 35 lb per sq ft , power loading 11 2 lb per hp

With the DH 86 successfully launched, the de Haviland Company took a leaf from the lessons learned in the new ship and drastically revised the older seven place Dragon The new machine, officially designated as the DH-89, bears a very marked resemblance to the 86 except that it is smaller in over-all dimensions and lacks the two extreme outboard engines The same care has been taken in fairing the engines and the landing gears and the extraordinarily high aspect ratio and strong taper of the wings in planform have been retained The remarks above regarding construction of wings and fuselage for the DH-86 apply equally well to the 89

In performance, the new Dragon shows considerable advance over the older standard model Some of the improvements accrue from the use of the higher horsepower Gypsy Six engines and the rest from improved aerodynamic design. The general specifications are span 48 ft 0 in., length overall 34 ft 6 in , height 9 ft 10 in , wing area (including ailerons) 336 sq ft , weight empty 2,851 lb , gross weight 5,000 lb , wing loading 13.7 lb per sq ft , power loading 12 2 lb per hp , top speed (at 1 000 ft) 165 m p h , stalling speed 63 m p h ; service ceiling 19 500 ft

NEW VOLUMES FOR THE SHELVES

THE TURNING WHEEL, *by Arthur Pound, Doubleday, Doran & Company, New York, 1934, 517 pages*

FOR several years Arthur Pound has been earning a great reputation as a chronicler of industrial developments and an interpreter of the philosophy of industry, and when it was decided that the silver anniversary of the General Motors Corporation should be celebrated by publishing the history of the company it was natural that Mr. Pound should have been appealed to to undertake the authorship Naturally the book that results is devoted principally to the development of highway transportation but the world of aviation is close enough to that of the automobile so that even the history of the automobile would be interesting Interest becomes more specific in the chapter on research and in that entitled 'General Motors in Aviation" The aeronautical chapter is a brief one, and merely records the most important incidents from the construction of 2,500 Liberty engines and 3,000 DH4s during the War to the present mixture of manufacturing and (through control of North American Aviation) transport activities

Obviously the book has been done with great care and with a vast amount of research among the records of the early years As anyone who has known Mr. Pound's earlier work would have anticipated the skeleton of historical facts has been woven into a very appealing text

RAKETENFLUGTECHNIK, *by Eugen Sanger, Verlag R Oldenbourg Munich 1933, 218 pages $4.25 approximately*

ROCKET FLIGHT has occasioned less excitement in the last year or so than in that earlier period when Herr Opel was researching on his surprising craft and a host of imitators in Germany and America and elsewhere were threatening to blow themselves up with more or less ill-conceived schemes of propulsion by gunpowder Nevertheless it still possesses a scientific interest especially for stratospheric enthusiasts since the rocket drives by reaction and needs no air of any density upon which to work Dr Sänger provides a general textbook on the theory of the subject both thermodynamic and aerodynamic Very technical, it can be recommended only to those who propose to delve deep into rocket flight and are willing to spend plenty of time at it, but for them the book is the best of its kind that has so far appeared.

SILHOUETTES OF ROYAL AIR FORCE AIRCRAFT, *British Air Ministry, H M Stationery Office, London, 1933, 30 pages, 40 cents approximately*

THE TITLE well describes the book Each of the British military types now commonly employed is given a page of four silhouette drawings, showing the machine as seen from the front from the side from below and from the forward quarter and a little below the line of flight, respectively Planes of similar military function are all grouped together and all the drawings are to the same scale, the purpose of course being to facilitate recognition by characteristic elements of form This is an excellent idea and we wish it might be duplicated in America. The book is loose-leaf and new pages are to be issued for insertion as rapidly as new types appear in service

SEAPLANE SOLO, *by Francis Chichester Harcourt Brace & Company, New York 1934, 314 pages, $2.50*

ALL DISTANCES shrink when looked at from far away and Americans are likely to think of New Zealand and Australia as being practically one country In point of fact, it is 1,400 miles across the Tasman Sea, and when Mr Chichester set out to make the crossing alone in a Moth seaplane he had to plan for two intermediate landings on islands that are visited so rarely that he had difficulty in even finding out whether or not they were inhabited Nevertheless he made the trip and this is the story As a tale of flight it is like most of the other books that have been written on such subjects nothing very remarkable, and it gives an impression of being padded out to undue length and of a rather too conscious reaching out after dramatic effect Nevertheless it is above the average and in spots attains a very high level

The real entertainment for aeronautical readers however will come in the story of how Mr. Chichester crashed in taking off from one of his intermediate stopping places and rebuilt his airplane with the help of islanders who had never seen one Mr Chichester himself being a very competent pilot, but blissfully ignorant of every phase of aeronautical engineering and construction, the repair job would appear to have had some remarkable features, but it went through to a finish finally and the Moth again took the air to complete the trip A typical episode was the lengthy argument, reported in amusing detail, between the author and one of his volunteer helpers as to the degree of tautness which should be sought in sewing fabric onto the wing, and the final discovery, after a feminine helper had spent days and days stitching the fabric into place by hand, that the internal drag wires had been left out.

AIRCRAFT PERFORMANCE TESTING, *by S Scott Hall and T H. England, Pitman Publishing Corporation, New York and London, 1933, 206 pages, $4.*

THE primary purposes of "Aircraft Performance Testing" is to serve as a practical reference manual in making tests in accordance with the standard British official procedure The precautions to be taken in the actual conduct of a test and the methods used in working up the results are described in great detail, and in a fashion which should be extremely useful to those working under the British rules Several large folded charts inserted in the book illustrate the application of the recommended methods in particular cases Unfortunately British and American practices differ somewhat and the material in that section of the book is likely to be of interest only to particular students of performance testing and flight-research methods who will want to examine into the precise nature and extent of the differences between their own methods and those of the people engaged in the same work in Great Britain

The section on testing for stability and control should be of much greater interest to designers, but unfortunately it is so brief as to be limited almost entirely to the obvious American readers will learn with interest that the British specifications require for military aircraft that a spin of eight turns be followed by recovery within three turns after the controls are neutralized but they will learn little else of value

The last section of the volume is concerned with the theory of performance reduction and with the way in which performance varies with certain characteristics of the airplane Though there is little that has not been published before in some form and some of the conclusions are broad enough to be challenged it is a very useful compilation and distinctly the most valuable part of the book

TRANSPORT

Operations and Traffic Management

Gadget Aids Traffic Clerks

DURING the summer months the United Air Lines ticket office in Chicago is a busy place Some 1,900 telephone calls and 300 telegrams, regarding reservations on the airplanes scheduled out of Chicago daily, put considerable pressure on the crew of clerks and dispatchers detailed to handle the work. To avoid confusion in the office, a turn-table device was invented to handle the master control charts for plane reservations This consists of three octagonal frameworks mounted independently one above the other on a common spindle The reservation charts for each flight are mounted on the several faces of the rotable sections With this arrangement several clerks may work on reservations at the same time without confusion as any desired list may be quickly obtained without searching through files or piles of loose papers

A passenger bus and a dispatch motorcycle loading up at Stockholm's downtown airline office

United Air Lines' "merry-go-round" saves time and patience in handling plane reservations.

New Use for Railroads

FRENCH airways engineers have been investigating the possibilities of using railway right of way for airway marking as a substitute for the more usual roof markings familiar in this country Following a system developed by Capt Maurice Poumet large letters spelling out the names of towns are laid flat on the railway ties between the rails near the principal station The large white painted characters can be read easily from high altitudes under a wide range of atmospheric conditions

Up the Gangplank

AN apparatus that resembles more nearly the portable gangplank used to get passengers aboard ocean liners than anything that has yet appeared is in use at Candler Field, Atlanta, Ga., for the convenience of passengers of the Curtiss-Wright Condors flown by Eastern Air Transport The structural features of the device are obvious from the accompanying photograph With its pneumatic-tired undercarriage (built up of welded steel tubing) and full castering tail wheels, the device may be easily moved about the apron at the loading points Handrails and a rubber matting on the ramp make for safe and convenient use in all sorts of weather

Kiosk Ticket Office

KIOSKS of one sort or another are familiar sights in many European cities The idea has been elaborated upon somewhat by A. B Aerotransport for a city ticket office in Stockholm This polygonous structure, set apart from other buildings in a corner of a downtown park attracks the eye of the passerby and calls attention to the services offered by the airline The similarity to U S methods of transporting passengers and packages to and from the airport will be noted in the accompanying photograph Obviously the bus is put to other purposes when not required by the airline

Portable gangplank used by Eastern Air Transport for loading and unloading Condors at Candler Field.

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AIRPORT ACCESSORIES — **Pneumatic starters**

The Cleveland Pneumatic Tool Company,
Cleveland, Ohio

COMPRESSED air starting motors for "winding up" inertia starters on aircraft offered in two styles, the No 1600 with bayonet lock for attaching in same manner as high speed electric types, and the No 77 used to replace the ordinary hand crank The latter can be supplied with shaft extension up to 30 in. Both styles operate from air at 80 to 125 lb per sq in pressure.

AVIATION, *June, 1934*

ELECTRICAL EQUIPMENT — **Chargers**

Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa

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MATERIALS — **Cleaning compound**

Magnus Chemical Company,
Garwood, N J

SPECIAL cleaning compounds for aircraft parts available Magnus Aviation Cleaner is for hot dip cleaning processes for engine and other parts Magnus Airplane Body Cleaner is designed to remove dirt oil, etc. from doped surfaces of metal, wood or fabric It is non-inflammable, and leaves a polished surface. Can be used in high pressure spray cleaning plants

AVIATION, *June, 1934*

PARTS — **Tube couplings (catalog)**

Parker Appliance Company,
Cleveland, Ohio

THE first edition of Bulletin No. 35 covering tube couplings and allied equipment has been received. These parts are widely used for fuel, oil and pressure lines on aircraft The bulletin covers not only the specific products for aircraft plumbing, but outlines other industrial applications Contains specifications, instructions for installing, special tooling required, etc.

AVIATION, *June, 1934*

RADIO — **Airport transmitter**

RCA Victor Company, Inc,
Camden, N J

MODEL AVT-1 equipment designed for short range traffic control work around airports. Has effective range of about 15 miles Unit is crystal controlled, 15 watt input, capable of 100 per cent modulation when used with double button microphone Operates from 115 volt 50-60 cycle AC Factory pre-tuned to any desired frequency between 200-410 kc 16x18x23 in Weight 200 lb

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SHOP EQUIPMENT — **Air compressors (catalog)**

The Brunner Manufacturing Company,
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A REVISED line of air compressors suitable for shop or airport use is covered by the new Brunner Air Compressor Catalog No 28, just issued. Products include single-stage, twin-cylinder units, vertical tank models, and a number of two stage machines Engineering data on air compression, as well as details of compressed air accessories included. Copies available on request

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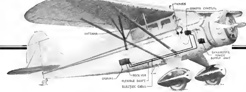

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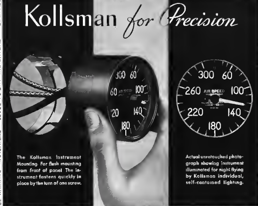

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md:33

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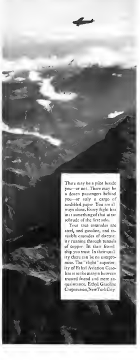

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Among the 10,000 and more readers of Aviation, *other* men who read this advertisement, *as you are doing,* are *also* interested in anything that has a part in the effective and economical operation of airports in whatever capacity used. How logical, then, to convey information of appropriate services, equipment, accessories, "opportunities," etc., to these men through advertising right here in these pages—*a simple fact, easily overlooked.*

(Suitable spaces, rates and forms are available in AVIATION for every type of advertising message)

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BALLOON AND AEROPLANE

We offer a Grade A fabric which, in addition to meeting A/N specifications, has unmatched uniform strength, is exceptionally free from yarn and weaving imperfections, and is most carefully graded. Higher initially, perhaps, but cheaper ultimately.

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Branches in leading cities

A Tight Connection All the Time

NOC-OUT THE HOSE CLAMP WITH THE THUMBSCREW

Standard equipment hose clamp of the automotive and airplane industry. Your jobber has them.

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Aeronautical University
Recommended by the Aviation Industry. Approved by Aeronautics Branch U. S. Dept. of Commerce. Est. in 1929 by Curtiss Wright. Latest equipment.
Aeronautical Engineering *(Degree)*
Master Mechanics—Administrative
Pilot's Ground Courses
Reasonable tuition. Write for free catalog K6
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DANIEL GUGGENHEIM SCHOOL OF AERONAUTICS
Graduate and Undergraduate Courses in Aeronautical Engineering and Air Transport. Particulars from Dean, College of Engineering
NEW YORK UNIVERSITY
University Heights, New York, N. Y.

STANDARD AIRCRAFT FINISHES
Since 1915
TITANINE
TITANINE INC. UNION, N. J.

Ride the Beam & Know Your Weather
Aircraft WESTPORT Radios
Westport Manufacturing Company
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Landplane Airports Seaplane Airports Design Supervision of Construction Management Counsel Transport Studies
A. P. TALIAFERRO, Jr.* & Co., Inc.
AIRPORT AND AIR TRANSPORT CONSULTANTS AND ENGINEERS
101 PARK AVENUE, NEW YORK
*Formerly Chief of Airport Section, U. S. Department of Commerce, [illegible]

RESEARCH
DESIGN
STRESS ANALYSIS

MANUFACTURING
FLIGHT TESTING
OPERATIONS

GRANVILLE, MILLER & DE LACKNER
CONSULTING
AERONAUTICAL ENGINEERS
Springfield Airport, Springfield, Mass.

IMPROVED DOPES
PHENIX CLEAR NITRATE DOPES
Clear—$1.05 per gal. in 50 gal. drums included
—$1.10 per gal. in 30 gal. drums included
—$1.20 per gal. in 5 gal. boxed cans
Pigmented—$1.90 per gal. in 5 gal. boxed cans
Yellow, Blue, Red, Green, Cream, Khaki, Aluminum, Black, White. Immediate shipments fresh high grade.
PHENIX AIRCRAFT PRODUCTS CO.
Williamsville, N. Y.

USE AIR EXPRESS FOR RUSH DELIVERIES

STANAVO

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AVIATION ENGINE OIL
ROCKER ARM GREASE

Hundreds of dependable facts, now in one convenient volume . . .

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—10 big sections covering nomenclature, aerodynamics, parasite drag, performance data, stability and control, materials, structural data, weight analyses, design standards

—large quantity of useful data on aerodynamic properties of airfoils, parasite resistance of stream line bodies and aircraft parts, etc

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—up-to-date, covers types of aircraft and equipment now in use, recent standards and specifications

—usable material. Textbook material, intermediate mathematical steps, etc., condensed to smallest possible space

". . . Will undoubtedly become a standard reference work"
—Western Flying

"Covers aviation with the same thoroughness and dependability as do handbooks in other fields of engineering"
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690 pages, 4½ x 7, illustrated, $7.50

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McGRAW-HILL ON-APPROVAL COUPON

McGRAW-HILL BOOK CO., INC., 330 W. 42d St., New York City

Send me Warner and Johnston's Aviation Handbook for 10 days' examination subject to approval or return. Within 10 days of receipt I will send $7.50, plus a few cents for postage and delivery, or return book postpaid. (We pay postage on orders accompanied by remittance.)

Name

Address

City and State

Position

Company

FA 6-34

(Books sent on approval in U. S. and Canada only.)

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EMPLOYMENT : BUSINESS : OPPORTUNITIES : EQUIPMENT—USED or RESALE

UNDISPLAYED—RATE PER WORD

Positions Wanted (full or part-time salaried employment only) 5 cents a word, minimum $1.00 an insertion, payable in advance. (See ¶ on Box Numbers)

Positions Vacant and all other classifications, including equipment, 10 cents a word, minimum charge, $2.00 an insertion.

Proposals 40 cents a line an insertion

INFORMATION

Box Numbers in care of our New York, Chicago and San Francisco offices count 10 words additional in undisplayed ads. Replies forwarded without extra charge.

Discount of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals)

DISPLAYED—RATE PER INCH

1 inch $6.00
2 inches .... 5.75 an inch
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An advertising inch is measured vertically on one column. 3 columns—30 inches—to a page

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Factory efficiency on overhauls available to Pratt & Whitney engine owners

Engines go through as a unit

From a complete tear down and cleaning of all engine parts—through inspection—distribution of parts to various sections of the shop — repairing or replacing — reassembly under production methods and finally a torque stand test, Pratt & Whitney engine overhauls are under the constant supervision of factory trained experts.

Then, too, Pratt & Whitney knows the history of every engine and maintains a complete stock of parts. Hence an efficiency in engine overhaul is offered which means that the completed unit leaves the overhaul shop in as good mechanical condition as when it originally left the manufacturing plant.

THE UNITED AIRPORTS OF CONNECTICUT, INC.

Division of United Aircraft & Transport Corporation

HARTFORD, CONNECTICUT

NOTICE—Effective July 1st, new engine parts formerly sold at 60% off list will be sold at discount of 50% off current list prices

AMERICAN AIRWAYS, INC.
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BLIND FLIGHT IN THEORY AND PRACTICE

By MAJ WM. C. OCKER and LT CARL J CRANE

No Pilot ... can afford to neglect the knowledge embodied in this book. —Rickenbacker

Permanent cloth bound book, over 200 pages, 114 illustrations. Price $3.50

THE NAYLOR CO
918 N. St. Marys, San Antonio, Texas

They "talk your language"

the other 10,000 and more readers of Aviation "talk your language"—are interested in everything related to the work of the field served by this paper—that's why advertisements of Employment, Equipment and Business Opportunities in the Searchlight Section of Aviation bring letters like these:

"This is to inform you that the ad inserted by us in the Searchlight Section of your magazine was the means of our selling the Amphibian."

"Wish to say that the For Sale ad I ran in the Searchlight Section sold the plane."

"Please discontinue my ad in your Searchlight Section. It brought immediate results and the articles advertised are sold."

"I inserted an ad in Aviation to appear in 3 consecutive issues and sent you my check in the sum of $7.50. Within three days from the first insertion I had received seven replies and had sold my plane at a satisfactory price."

POSITIONS WANTED

RECENT college graduate with aeronautical and mechanical engineering degrees. Flight training at Curtiss-Wright Aeronautical School. Open for proposition. H A Carmody, 1643 58th St, Brooklyn, N Y

YOUNG MAN, 19, wants work connected with Aviation. High school education. 25 hours solo. Herbert Sich, Locust, N J

YOUNG MAN, single, 25, graduate leading technical university, wants work design, experimental department. Excellent health, willing worker. References. Anywhere. Employed. PW-260, Aviation, 520 No. Michigan Ave, Chicago, Ill

FOR SALE

Stinson

4-place Warner motor licensed, motor and plane in A-1 shape. Privately owned, never cracked up. Bargain. Must be paid all cash. FS-261, Aviation, 520 No. Michigan Ave, Chicago, Ill

Spartan Biplane

For sale, 3 passenger, dual controls, motored with Walters 120 hp engine, Hamilton steel propeller. Engine and plane completely rebuilt. N. C. license till May 1935. Reasonably priced for quick sale. State Trade School, P. O. Box 440, Putnam, Conn

Curtiss Junior

Like new, just relicensed. Will sacrifice for $425.00. Also Robin Waco 10 and Command-Aire parts. N. F. Steffee, 370 Humboldt Pkwy, Buffalo, N Y

Universal Propellers

OX5 $10.95, Lefever, Velie $18.85, Szekely, Continental $15.75. Sportplane, boat and sled propellers, $3.95 up. Send 25c for leather bound flying manual, photos and information on sensational $98.00 aeroplane. Hibbs, Ft Worth, Texas

Pitcairn Autogiro

PCA-2, 300 hp Wright, fully licensed. Good flying condition. Total time 900 hours. FS-262, Aviation, 330 West 42d St., New York City

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thoroughly experienced and well prepared to handle either position or the dual capacity. Valuable aeronautical contacts.

PW-263, Aviation
330 West 42d Street, New York City

NEW SHIPS AT LOWEST PRICE IN HISTORY

1—Lincoln Page OX5 biplane, ship and motor brand new, $850
1—American Eagle biplane OX5, 6 hours, $750
1—American Eagle 2 place cabin monoplane, 14 hours on ship. New 165 hp Continental Motor and lots of extras, $2,250
1—American Eagle Model 201 biplane, Kinner K-5, 2 hours, lots of extras, $1,150
1—Amer. Eagle biplane Kinner K-5, 6 hrs, $850
1—American Eagle biplane OX5, 85 hours and a dandy, $6..
1—Long wing Eaglerock biplane complete less motor and right lower wing, $150
1—Lincoln Page trainer Kinner Motor, practically new, $650
5—Hisso Motors, late type, model A, 150 hp, still in Government crates, $100 each
1—OX5 Motor overhauled, $75
1—OXX6 Motor overhauled, $85

BLOSSER MOTOR COMPANY
Concordia, Kansas

INDEX TO ADVERTISERS

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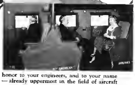

American Airlines have sponsored the first, luxurious "Sleeper Plane"—now flying on regular schedule. Unprecedented comfort—security—speed—safety—all are combined in this giant "Pullman of the Air"—the newest forward step in air transportation. Congratulations, American Airlines!

Congratulations, Curtiss-Wright! This "Sleeper Plane" of your design and construction does honor to your engineers, and to your name—already uppermost in the field of aircraft construction.

The Shell Petroleum Corporation takes pride in the fact that test flights of the "Sleeper Plane" were made with Shell Aviation Gasoline—and that it flies now with Shell Aviation Gasoline—on schedule!

"Speed With Safety"

SHELL PETROLEUM CORPORATION
ST. LOUIS, MISSOURI

SHELL

3 AIR MAIL RECORDS WITHIN 3 MONTHS

Powered by WRIGHT CYCLONES

WRIGHT CYCLONES have formed a habit of smashing transcontinental air mail records Three times within the past three months, Cyclone-powered commercial and military aircraft have established new transcontinental air mail records—carrying mail across the United States from the Pacific Coast financial and industrial centers to New York in progressively improving time Following is a brief outline of the three record-breaking flights

1 T W A Douglas Airliner, powered by two Wright Cyclones, spanned the continent from Los Angeles to New York in 13 hours and 4 minutes This flight was made on the last day before cancellation of commercial air mail contracts

2 U S Army Air Mail flight from San Francisco to New York in 13 hours and 53 minutes Two laps of the journey were made in Martin B-10 Bombers, powered by two Wright Cyclones, and one lap in a Curtiss A-12 Ground Attack Plane, powered by a single Wright Cyclone. This flight was made on the last day before the Army turned the air mail back to commercial airline operator

3 T W A Northrop Gamma, powered by a Wright Cy clone, spanned the continent from Los Angeles to Ne York in 11 hours and 31 minutes This flight was made the day that T W A resumed its operations of carryi the air mail

The outstanding performance of the Wright Cyclo Engine has influenced many of the world's leadi airline operators to specify "Cyclones" as power equi ment for their latest types of high-speed transport Following are a few representative examples 4 T W A Douglas Airliners, 6 T W A Northrop Gamm mail planes, 6 Pan American Airways Douglas Ai liners, 3 Pan American Airways Kreider-Reisner Am phibions, 25 American Air Lines Curtiss-Wright Co dors, 9 Eastern Air Lines Curtiss-Wright Condors, American Air Lines Airplane Development Corpor tion V-1 Transports, 3 K L M (Royal Dutch Ai lines) Fokkers, 1 Swissair Curtiss-Wright Condor a 1 Swissair General Aviation GA-43.

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